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August 1991

Canonie Environmental

Data Report

Soil and Water Test Results November 1990 to June 1991 New Slip Area

Waukegan Harbor Superfund Site
Waukegan, Illinois

Prepared For:

Waukegan Harbor Trust

CanonieEnvironmental

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August 16, 1991

90-407-02

Ms. Cindy Nolan
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Office of Superfund - MC5HS11
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Transmittal
Data Report
New Slip Area
Waukegan Harbor Project

Dear Ms. Nolan:

Attached are three copies of Canonie Environmental Services Corp.'s (Canonie) report on the soil and water data from the New Slip area.

If you have any questions, please call.

Very truly yours,

Kevin M. Brissette

Kevin M. Brissette, P.E.
Project Supervisor

KMB/cp

Enclosures

cc: Arlyn Albrecht, Waukegan Habor Trust
Jeffery Fort, Sonneschein, Nath & Rosenthal
Glen Lenzi, Outboard Marine Corporation
Scott Moyer, Illinois Environmental Protection Agency

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Canonie Environmental

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DATA REPORT
SOIL AND WATER TEST RESULTS
NOVEMBER 1990 TO JUNE 1991
NEW SLIP AREA
WAUKEGAN HARBOR SITE

1.0 INTRODUCTION

On behalf of the Waukegan Harbor Trust (the Trust), Canonie Environmental Services Corp. (Canonie) presents A Data Report for the New Slip Area, Waukegan Harbor Site, (the Report). The Report contains information concerning:

1. The sampling, excavation, and containment of soils containing polynuclear aromatic hydrocarbons (PNAs) from the location of the New Slip.

2. The sampling, storage, and treatment of underdrain water taken from the PNA soils containment.

3. The sampling and analysis of the water in the New Slip.

The report is provided in response to the U.S. Environmental Protection Agency's (EPAs) October 24, 1990 request and reiterated in a June 11, 1991 letter for a report demonstrating conformance with the design for additional work handling and containing PNA-containing soils at the New Slip.

1.1 Background Soil Excavation

In January 1989 Canonie installed four borings, S-1, S-2, S-3, and S-4 in the proposed Area of the New Slip. The borings were to obtain geotechnical information for the construction of the New Slip which was an integral part of the Waukegan Harbor Remedial Action. The purpose of the borings and the methodologies to be used in installing the borings were discussed in the remedial action work plan for the in place

containment (a part of the Consent Decree for Waukegan Harbor). The locations of the four original borings are shown on Figure 1.

During the installation of these borings, soils were encountered at Boring S-2 which had a distinct petroleum product odor. A sample of the soil was recovered and analyzed by the Outboard Marine Corporation (OMC). The analysis indicated the presence of base neutral extractable compounds, most predominantly polynuclear aromatic compounds. As a result of the initial finding, six additional borings labeled S-36, S-37, S-38, S-39, S-40, and S-41, were installed in a perimeter area around Boring S-2 to determine from both a visual and analytical basis, the extent of the soil contamination found at Boring S-2.

The results from Boring S-2 and the surrounding borings were reviewed with the EPA in the spring of 1989 and resulted in a proposal by the Waukegan Harbor Trust to perform additional soil borings centered around Boring S-2 to find the extent in both a horizontal and vertical direction of soils containing polynuclear aromatic compounds. Sampling for the EPA-approved program occurred in July and August of 1989, with samples taken at the five foot, 15 foot, and 25 foot depth in all borings sampled. Based on visual results as samples were taken, the boring program was expanded in certain areas to complete the definition of soils within the area proposed for the new slip construction. In September of 1989, three further borings were installed north of the original investigation area, and four monitoring wells were installed in two clusters. The borings taken during the summer of 1989 are shown on Figure 1 and are indicated by two digit identification numbers. The results of the 1989 investigations were summarized in a report entitled "Draft Data Summary Report, New Slip Soil Investigation, Waukegan, Illinois," which was submitted to the EPA in March 1990.

Results of the 1989 investigations were assessed by both the Waukegan Harbor Trust and the agencies in late 1989 and the early parts of 1990. Based on risk assessment, the Waukegan Harbor Trust proposed a six part per million (ppm) carcinogenic PNA

action level, and the EPA arrived at a five ppm carcinogenic PNA action level. The carcinogenic PNA action level was selected by the EPA as the measure for "designating" soils for removal and containment during the construction of the New Slip. During the summer of 1990, Canonie prepared a design for a temporary containment cell to hold the designated soils excavated during the construction of the New Slip. The criteria for the construction of the designated soil containment cell are contained in Appendix N of the approved Design and Analysis Report for the Waukegan Harbor Superfund Site. The design includes a bermed area with a bottom synthetic liner and underdrain system filled with the designated soils and a final synthetic liner cover.

During the same time interval, three areas which contained or may have contained designated soils with carcinogenic PNA levels above 6 ppm were designated as Area A, Area B, and Area C. The three areas are shown on Figure 4. Both Area A and Area B were known to contain soils with a carcinogenic PNA level greater than 6 ppm in soil samples at a five-foot depth and at several locations within each area at the depth of 15 feet. Area C was an area located under an existing sand pile along the east dock wall of the Upper Harbor of Waukegan Harbor. Area C was an area of unknown characteristics, and was suspected of containing designated soils.

Based on the large area of PNA-containing soils known as Area B, and the conflict with the proposed location for the New Slip, the Waukegan Harbor Trust proposed moving the slip northward to avoid Area B. This move was discussed with Larsen Marine Services during the summer of 1990, and various modifications were made to optimize Larsen's proposed use of the slip.

During the development of the designated soil containment cell design, Canonie also proposed an additional sampling plan to:

1. Sample soils in the Area C which could not be sampled until the sandpile was removed.

2. Obtain additional samples in Area A to confirm vertical and horizontal extent of soils requiring removal.

3. To obtain two additional deep samples in the northern areas of the proposed relocated New Slip.

The procedures for obtaining these samples and the sampling program were presented in Appendix M of the approved Design and Analysis Report for the Waukegan Harbor Superfund Site.

Approval for construction of the New Slip was received from the EPA on October 16, 1990. The soil borings and analysis as required in Appendix M of the design and analysis report were completed in November of 1990. The results of the analysis indicated that there were no soils classified as designated soils in Area C. The extent of soils containing PNAs at the designated level in Area A was not confirmed, based on the first sampling round.

In the interim period, a second round of sampling, including the sampling of debris and suspect soils encountered during construction of starter trenches for installing the steel sheeting that would form the New Slip were obtained and analyzed. As a result of this analysis, three areas outside of Area A were identified for shallow excavation and containment as designated soil. In late January of 1991, a third sampling event was completed to address the concerns of the EPA to further define the vertical and horizontal extent of PNAs within Area A. The results from that investigation defined horizontal extent but did not define to the EPA's satisfaction vertical extent of PNAs in Area A. The original assessments performed by both the Waukegan Harbor Trust and the agencies were based upon dermal contact or ingestion of soils containing carcinogenic PNAs. However, the agency believed that excavation should extend to the depth at which soils showed carcinogenic PNAs were less than the agreed upon designated soil limit and would not accept Canonie's and the Trust's proposal to

terminate the excavation at 15 feet. The proposal terminated the excavation at 15 feet because soils below 15 feet would be unlikely to result in exposure by either ingestion or dermal contact.

A fourth round of sampling was therefore undertaken in late February, 1991 to define the vertical extent of PNAs within Area A. The results of this investigation indicated that a portion of Area A between the south wall of the New Slip and the tieback wall required excavation to the clay till surface at a depth of approximately 26 feet below grade. Another portion of Area A required excavation to only 15 feet. In addition, during these activities, further surficial designated soil was encountered immediately adjacent to Area A. The final excavation areas within Area A are shown on Figure 5.

1.2 Stockpile Underdrain Water

A high density polyethylene (HDPE) lined containment cell was built in December 1990 to provide secure storage for the designated soils excavated while constructing the New Slip. This designated soils stockpile was open to precipitation events from mid-December 1990 to mid-April 1991 to allow for placement of the designated soils. Because of the size of the containment cell (120 feet square) it was impractical to cover the cell. In addition, approximately one half of the total volume of designated soils placed in the containment was excavated from below the ground water table. These two factors led to a significant accumulation of water inside the cell. The report discusses the handling of the underdrain water, including its removal from the cell, temporary storage, and eventual treatment and discharge.

1.3 Background

Prior to opening the New Slip by removing the existing harbor sheeting, a sample of the New Slip basin water was taken in early April 1991. The analytical results of the sample revealed the presence of certain compounds at concentrations higher than applicable

criteria. Several further samples of the water and sediments were obtained during a period of about one month ending May 2, 1991. The report discusses the results of the sampling and the opening of the New Slip.

2.0 SOIL SAMPLING EVENTS

All sampling that occurred after the October 16, 1990 approval to construct the New Slip was for further definition of the vertical and horizontal extent of soils containing more than the designated level of PNAs.

The first sampling event included Borings S-101 through S-113 as described in Appendix M. The second sampling event included Borings S-114 and S-115 to investigate the soils in the New Slip extension area. The third sampling event, which included Borings S-118 through S-127, and the fourth sampling event, which included Borings S-132 through S-137, were performed to define the extent of impact within the boundaries of Area A. The original limits of Area A were based on the results of the pre-March 1990 investigations. The grab samples were taken from unknown areas of concern that were discovered as a result of New Slip construction activities.

Two borings drilled during the second sampling event, Borings S-116 and S-117, were drilled on Larsen Marine Service's (Larsen's) property in an area where Larsen is considering building expansion. These two borings have no bearing on the definition of PNA impact and excavation limits. However, boring logs and associated analytical results are included in the report.

This portion of the report will provide a summary of each sampling event. The discussion will focus on the physical aspects of the sampling. This will include, but may not be limited to, boring installation and sampling procedures, sampling intervals, and soil characteristics.

2.1 First Sampling Event

Boring activities for the first sampling event, Borings S-101 through S-113, began November 16, 1990 and ended November 26, 1990. The boring locations are shown on

Figure 1. Borings S-101 and S-102 were drilled in the eastern portion of the New Slip area to provide information on the deep soils because previous borings (S-39 and S-40) were advanced to a shallow depth. Borings S-103 and S-104 were drilled in the originally defined Area A to determine the depth of PNA impact.
Borings S-105 through S-108 were drilled in the originally defined Area C to characterize the soils underneath the north end of the sand pile. The remaining borings were drilled in areas where excavated materials from the New Slip construction were to be stockpiled. Also, a 100-foot-long exploratory trench was excavated to the water table in the proposed excavated soil stockpile area for visual inspection (Figure 1).

2.1.1 Boring Installation and Sampling Procedures

The soil borings were installed in the following manner. Each boring was advanced approximately 10 feet using clean, continuous flight augers. A 10-foot-long temporary steel casing was inserted into the borehole for mud-rotary drilling. Drilling mud was mixed by adding bentonite to water obtained from a city of Waukegan fire hydrant. The remainder of the borehole was drilled with the bentonite drilling mud and a tricone roller bit. At the required sampling depths, the roller bit was removed from the hole and the sampling device was introduced into the borehole. Upon completion, the borehole was backfilled by pumping a cement-bentonite grout mixture through the drilling rods. The drilling rods and temporary wash casing were removed from the backfilled borehole.

Soil samples were obtained in the following manner. Clean brass liners were inserted inside a clean split-spoon sampler. The sampler was inserted into the borehole and driven into the soil with a rig-mounted hammer. The sampler was extracted from the borehole and opened. Before and after opening the sampler, an organic vapor analyzer (OVA) was used to check the sample for volatile organics. Samples designated for analysis were covered on both ends with aluminum foil, capped, and taped. The samples were stored on ice in a cooler until shipment to the analytical laboratory.

Before drilling the first boring and between borings, all drilling and sampling equipment was cleaned with a pressure steam spray.

2.1.2 Sampling Intervals

The sampling intervals used during the first event are outlined in Appendix M. The general protocol was three samples per boring (at approximately five feet, 15 feet, and 25 feet). The borings in Area A and Area C were sampled continuously between five feet and 15 feet because it was believed, based on the results from 1989, that PNA impact, would be in the five to 15 foot interval. Sampling intervals are noted on the boring logs included in Appendix A.

2.1.3 Soil Characteristics

The characteristics of the soil were very uniform throughout the New Slip area. A fine to medium sand unit exists from ground surface to a depth varying between 25 and 27 feet. Most of the borings revealed a six-inch to two-foot thick layer of coal "breeze" (compacted coal fines) at about one foot below the ground surface. The presence and thickness of this layer was confirmed during excavation activities. In general, the coal layer was more prevalent in the eastern portion of the New Slip area. As expected, at the lower extent of the sand layer, a very hard silty clay unit was present. Coarse sand and fine gravel were also present in small quantities at the interface between the sand and clay. The hard silty clay layer was not significantly penetrated during the first sampling event. Therefore, the sampling was essentially restricted to the sand unit. However, the hard clay was found at the tip of the bottom sample in some borings, confirming the consistency of the depth to the sand/clay interface.

From ground surface to a depth of about seven or eight feet, the sands are light brown in color. At that depth, a change to gray and dark gray color occurs. In most of the borings, the color change was distinct and the gray sands became darker with depth.

Only Borings S-111 and S-112 did not have a distinct color change. The sand color in these borings gradually changed from light brown to light gray with depth, never exhibiting the dark gray color observed in the other borings. These two borings were drilled in the southern depression in the east side of the sand pile, some distance from the previously discovered PNA-impacted areas.

All of the borings other than S-111 and S-112 produced a distinct odor of varying strength. The odor is most applicably described as a mixture of a naphtha-product odor and a petroleum odor. In Borings S-101, S-102, S-109, and S-110, the odor was only noticed in the deep sample (24.0 to 26.0 feet). In Boring S-113, the odor was only noticed in the 15.0 to 17.0-foot sample. In all the remaining borings (S-103 through S-108), the odor was present in samples between five and 15 feet, but not in the deep sample. However, a deep sample was not taken from Borings S-103 and S-104. The strongest odors noticed during the first sampling event were in the deep samples of Borings S-109 and S-110.

2.2 Bulkhead Wall Trench Samples

Prior to driving any sheeting for the south bulkhead wall, preparatory trenches were excavated along the driving line. The trenches, dug approximately to the water table, were needed to remove rubble and other material which would have made it difficult to set the sheets. The first three to four feet of soil throughout the area was comprised of fill and the coal layer. When frozen, the coal layer would have been nearly impenetrable and setting the sheets on a straight driving line would have been impossible.

Where on map?

Excavation of the trench for the original location of the south bulkhead wall (nearly 240 feet of the wall east of the harbor was eventually relocated 20 feet to the south) revealed two areas of moderately suspect soils and one area of highly suspect soils. The former areas were located approximately 65 feet and 95 feet east of the existing harbor wall. The soils were distinguished by a dark color. The latter area was located approximately

195 feet east of the harbor wall. A concrete slab was discovered at this location and the soils underneath the slab were very dark. Also, distinct interfaces between the dark soils and apparently non-impacted soils were evident at both the east and west ends of the slab location.

One side wall sample was taken from each of the first two areas on December 6. These samples were designated as NSWT (New Slip Wall Trench) S-1 and NSWT S-2. A side wall sample was taken from each side of the interface described in the third area on December 6. These samples were designated as NSWT S-3 (dark soils) and NSWT S-4 (apparent non-impacted soil).

The trench for the final location of the south bulkhead wall did not reveal any suspect soils. However, a side wall sample was taken from the trench at two separate locations, approximately 55 feet and 115 feet east of the harbor wall on December 11. These samples were designated as NSWT S-5 and NSWT S-6. Locations for all of the NSWT trench samples are shown on Figure 2.

2.3 Second Sampling Event

Between January 3, 1991 and January 4, 1991 a second round of borings were installed to provide further information on the soils in the area of a proposed 100 foot extension of the New Slip and at Larsen's Boat Service Facility. Borings S-114 through S-117 were drilled during this period. Borings S-114 and S-115 were drilled to provide further information on the soils in the New Slip extension area. Their locations are shown on Figure 1. Borings S-116 and S-117 were drilled just east of Larsen's In-Out boat service building. Their locations are shown on Figure 3. Also, an exploratory trench was excavated to the water table in the New Slip extension area for further visual inspection (Figure 1). Two side wall samples were taken from the trench on January 4. They were designated as SEET (Slip Extension Exploratory Trench) S-1 and SEET S-2, located at the north and south ends of the trench, respectively.

2.3.1 Boring Installation and Sampling Procedures

The soil borings were installed in the following manner. Each boring was advanced using clean, hollow-stem augers. At the required sampling depths, the sampling device was introduced into the borehole. Upon completion, the borehole was backfilled by pumping a cement-bentonite grout mixture through the augers. The augers were removed after being filled with grout. After removal of the augers, the remaining portion of the open borehole was filled with grout.

Soil samples from the borings were obtained in the same manner described for the first sampling event. Two side wall samples from the trench were obtained by pushing a brass liner into the side wall. After extraction from the side wall, the brass liners were handled following the same procedure used for the boring sample brass liners. Before drilling the first boring and between borings, all drilling and sampling equipment was cleaned with a pressure steam spray.

2.3.2 Sampling Intervals

The sampling intervals used during the second event followed the protocol of three samples per boring (at about five feet, 15 feet, and 25 feet). Sampling intervals are noted on the boring logs included in Appendix A. Samples from the trench side walls were obtained from a depth between three and four feet below ground surface.

2.3.3 Soil Characteristics

The characteristics of the soil sampled during the second event were very similar to the soils sampled during the first event. The only difference in stratification was noted in Borings S-116 and S-117. Also, the hard clay layer was not penetrated by any of the borings which were terminated between 26.5 and 27 feet in depth. These borings did not reveal the coal layer found throughout the New Slip area. The color of the soils in

the four borings changed from light brown to dark gray with depth. With the exception of Boring S-114, the odor described above was noticed in all of the borings below 15 feet.

2.4 Anchor Wall Trench Samples

Excavation of the trench for the south anchor wall sheeting east of the jog in the wall revealed an area of visually impacted soils. At approximately 10 feet east of the jog, several pieces of large concrete rubble were discovered. The rubble extended to a depth of about nine feet. Very dark soils were mixed with the rubble and an oily sheen was apparent on the wet soils and water in the trench. The dark soils extended along the trench line for approximately 15 feet. The location of the rubble coincided with the location of three attempted borings (S-2A through S-2C) from the January 1989 investigation. These borings had to be aborted because of obstructions just below the surface.

A soil sample was collected from the trench sidecast pile on January 16. The sample was designated STBT (South Tie-Back Trench) S-1. The location of the sample is shown on Figure 2.

2.5 Third Sampling Event

Boring activities for the third sampling event began January 23, 1991 and ended January 24, 1991. Borings S-118 through S-127 were drilled during this period. The boring locations are shown on Figure 1. Borings S-118 through S-123 were drilled within the boundaries of Area A to better identify and delineate the limits of PNA impact. With the discovery of unknown impacted areas during excavation of the basin, some concern was raised over the capacity of the designated soils stockpile. This sampling event was intended to reduce the limits of excavation, thereby reducing the amount of non-designated material placed in the stockpile. Borings S-124 and S-125 were drilled

in the area where trenching had encountered a buried concrete pad with visibly stained soils beneath it. The trench was dug to remove shallow obstructions in the sheeting line prior to driving pile. Borings S-126 and S-127 were drilled to provide further information on the soils in the New Slip extension area.

2.5.1 Boring Installation and Sampling Procedures

The soil borings were installed in the following manner. Each boring was advanced using clean, hollow-stem augers. At the required sampling depths, the sampling device was introduced into the borehole. Upon completion, the borehole was backfilled by pumping a cement-bentonite grout mixture through the augers. The augers were removed after being filled with grout. After removal of the augers, the remaining portion of the open borehole was filled with grout.

Soil samples from the borings were obtained in a manner similar to that described for the first sampling event. The difference was that samples sent to the analytical laboratory were collected in glass jars instead of brass liners.

Before drilling the first boring and between borings, all drilling and sampling equipment was cleaned with a pressure steam spray.

2.5.2 Sampling Intervals

Several sampling intervals were used during the third event. Borings S-118 and S-119 were sampled continuously from six feet below surface to 12 feet. Borings S-120 through S-125 were sampled from four feet to six feet. Borings S-126 and S-127 followed the protocol of three samples per boring (at approximately five feet, 15 feet, and 25 feet). Sampling intervals are noted on the boring logs included in Appendix A.

2.5.3 Soil Characteristics

The characteristics of the soil sampled during the third event were very similar to the soils sampled during the first two events. The soils were a fine to medium sand gradually changing from brown to gray with depth. The hard clay layer was not penetrated by either of the deep borings. The soil samples from these borings were gray to dark gray and had an oily appearance. The odor described above was present during the drilling of both borings.

2.6 Confirmation Samples

On February 15, three isolated areas of designated soils were excavated and placed in the designated soils stockpile. These areas were defined using the analytical results of samples discussed above and are shown on Figure 4. Completion of excavation for Area 2 and Area 3 was based on visual inspection, and a sample from the excavation bottom of each area was obtained to confirm removal of the designated soils. The samples were designated as A2-CONF and A3-CONF, respectively.

2.7 Fourth Sampling Event

Boring activities for the fourth sampling event began February 26, 1991 and ended February 27, 1991. Borings S-132 through S-137 were drilled during this period. The boring locations are shown on Figure 1. Borings S-132 through S-135 were drilled within the area bounded by the east and west sides of Area A and the south bulkhead and anchor walls to determine the depth of PNA impact and thus, the vertical limits of excavation. Borings S-136 and S-137 were drilled north of the south bulkhead wall and west of the jog in the south bulkhead wall to determine the vertical extent of PNA impact discovered during installation of the support piles for the Area A excavation.

2.7.1 Boring Installation and Sampling Procedures

The soil borings were installed in the following manner. Each boring was advanced using clean, hollow-stem augers. At the required sampling depths, the sampling device was introduced into the borehole. Upon completion, the borehole was allowed to cave in naturally as the augers were removed because the material was to be excavated.

Soil samples from the borings were obtained in the same manner described for the third sampling event. Before drilling the first boring and between borings, all drilling and sampling equipment was cleaned with a pressure steam spray.

2.7.2 Sampling Intervals

The sampling intervals used for Borings S-132 through S-135 were at 18 feet, 21 feet, and 24 feet below surface. Borings S-136 and S-137 were sampled continuously from five feet to 11 feet. Sampling intervals are noted on the boring logs included in Appendix A.

2.7.3 Soil Characteristics

The characteristics of the soil sampled during the fourth event were very similar to the soils sampled during the other events. The soils were a fine to medium sand. The hard clay layer was not penetrated by any of the deep borings. All of the borings exhibited noticeable characteristics of PNA impact. The cuttings and samples from these borings were gray to dark gray. The samples taken from Borings S-136 and S-137 at five feet both had an oily appearance. The odor described above was present during the drilling of the borings.

3.0 ANALYTICAL RESULTS

All of the soil samples obtained during the events described in Section 2.0 of the report were submitted to CompuChem Laboratories in North Carolina and analyzed for semi-volatile organic compounds (SVOCs). The SVOCs include phenols and PNAs. Select samples from the first sampling event discussed in Section 2.1 were also analyzed for volatile organic compounds (VOCs) and priority pollutant metals (metals). All of the results are summarized in Tables 1 and 2.

The QA/QC review of the analytical data is not complete at this time. The results of the review and the raw analytical data will be submitted at a later date.

The purpose of the sample analyses was to define various soils as "designated" or "non-designated." Designated soils for the New Slip area were those having a combined carcinogenic PNA concentration greater than or equal to 6.0 parts per million (ppm). The seven known carcinogenic PNAs are benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene.

The following portion of the report presents the analytical results obtained from the sampling events.

3.1 First Sampling Event

Final results from the first sampling event were received in two parts on December 14, 1990 and December 17, 1990. The results are summarized in Tables 1 and 2. Soils from four areas of general concern were sampled. Those areas were the eastern portion of the proposed New Slip basin, Area A, Area C, and proposed stockpile areas for excavated materials. Each area will be discussed separately. For purposes of

discussion, "shallow" will be used to indicate the five-foot sampling depth, "middle" will be used to indicate the 15-foot sampling depth, and "deep" will be used to indicate the 24-foot sampling depth.

3.1.1 Eastern Portion of New Slip Basin

Borings S-101 and S-102 were drilled in the eastern portion of the proposed basin. Three samples from each boring were submitted for SVOC analysis. The shallow and middle samples from both borings contained low levels of non-carcinogenic PNAs and phenols in the range of 1.2 and 0.4 ppm, respectively. No carcinogenic PNAs were present in either boring. The deep samples from each boring contained high levels of phenols at 192 ppm (S-101) and 122 ppm (S-102). However, previous investigations had revealed the presence of phenols immediately above the top of the hard clay.

3.1.2 Area A

Borings S-103 and S-104 were drilled within the boundaries defined as Area A. From the results of previous investigations, Area A was known to contain designated soils. The purpose of the borings was to define the vertical extent of those impacted soils, which was thought to be between five feet and 15 feet below the surface. Therefore, each boring was sampled continuously in that interval. Based on visual and olfactory characteristics, two consecutive sampling intervals were selected for laboratory analysis by the field engineer. The shallower sample was analyzed, and if the carcinogenic PNA content exceeded 6 ppm, the following sample was to be analyzed.

Samples submitted from Boring S-103 were taken from nine feet and 11 feet and designated as S-A1 and S-A2, respectively. Sample S-A1 contained various non-carcinogenic PNAs, primarily naphtha compounds. The total concentration was 8.3 ppm. No carcinogenic PNAs were detected. Therefore, Sample S-A2 was not analyzed.

Samples submitted from Boring S-104 were taken from 11 feet and 13 feet and designated as S-A1 and S-A2, respectively. Sample S-A1 contained various non-carcinogenic PNAs with a total concentration of 17.4 ppm. Total carcinogenic PNAs were detected at a level of 1.1 ppm. Therefore, Sample S-A2 was not analyzed.

3.1.3 Area C

Borings S-105 through S-108 were drilled within the boundaries defined as Area C. No information was generated for this area prior to December 1990 because it was covered by the sand pile from past dredging at the mouth of the harbor. The purpose of the borings was to determine if the impacted soils in Area A extended west under the former sand pile. Each boring was sampled in the same manner as the borings in Area A. Additionally, a deep sample was taken from each boring.

Samples submitted from Boring S-105 were taken from nine feet and 11 feet and designated as S-A1 and S-A2, respectively. The deep sample was designated as S-6. Sample S-A1 had a total non-carcinogenic PNA concentration of 2.5 ppm. No carcinogenic PNAs were detected. Therefore, Sample S-A2 was not analyzed. Sample S-6 contained a total phenols concentration of 16.4 ppm.

Samples submitted from Boring S-106 were taken from 11 feet and 13 feet and designated as S-A1 and S-A2, respectively. Sample S-A1 contained various non-carcinogenic PNAs, primarily naphtha compounds, at a total concentration of 17.6 ppm. No carcinogenic PNAs were detected. Therefore, Sample S-A2 was not analyzed. Sample S-6 contained total phenols and total non-carcinogenic PNA concentrations of 52.2 ppm and 3.2 ppm, respectively.

Samples submitted from Boring S-107 were taken from nine feet and 11 feet and designated as S-A1 and S-A2, respectively. The deep sample was designated as S-6. Sample S-A1 had a total non-carcinogenic PNA concentration of 6.3 ppm. No

carcinogenic PNAs were detected. Therefore, Sample S-A2 was not analyzed. Sample S-6 contained a total phenols concentration of 16.2 ppm.

Samples submitted from Boring S-108 were taken from nine feet and 11 feet and designated as S-A1 and S-A2, respectively. Sample S-A1 contained a total non-carcinogenic PNA concentration of 6.1 ppm. No carcinogenic PNAs were detected. Therefore, Sample S-A2 was not analyzed. Sample S-6 had a total phenols concentration of 86.9 ppm.

The analytical results from Area C indicated that the PNA impact found in Area A did not extend into Area C. The deep samples showed the presence of phenols directly above the clay till, but no soils were classified as designated. Therefore, soils from Area C were not required to be placed in the containment cell as designated soils.

3.1.4 Stockpile Areas

Borings S-109 through S-113 were drilled in locations proposed for use as stockpile areas. The purpose of the borings was to provide information on soil which would become inaccessible for future remedial investigation on the site. The toe of the stockpile extends approximately 50 feet further east than planned, see Figure 1, because a large volume of soil was excavated than anticipated. Borings S-109 and S-113 were drilled in the area of the designated soils stockpile. Samples from Boring S-113 were subjected to visual inspection only. Boring S-110 was drilled in the northern depression in the east face of the sand pile. Borings S-111 and S-112 were drilled in the southern depression in the east face of the sand pile. Furthermore, a 100-foot-long east-west trench was excavated to the water table between Borings S-111 and S-112 for visual inspection and OVA screening. Three samples were obtained from each boring as with Borings S-101 and S-102. In addition to the SVOC analyses, selected samples from Borings S-109 and S-110 were analyzed for VOCs and metals.

3.1.4.1 Semi-Volatile Organic Compounds

Results for samples from Borings S-109 and S-110 were similar to each other. Relatively low levels of total non-carcinogenic PNAs were found in all of the samples, ranging from 0.05 ppm to 3.9 ppm. The shallow sample from Boring S-109 contained total phenols at 1.4 ppm. Both deep samples contained elevated levels of total phenols, with concentrations of 249 ppm in Boring S-109 and 21.6 ppm in Boring S-110. No carcinogenic PNAs were detected in any of the samples.

No compounds were detected in any of the samples from Borings S-111 and S-112 except for bis (2-ethylhexyl) phthalate in the shallow sample of Boring S-112 at an estimated 0.04 ppm. The exploratory trench between the two borings showed no visual evidence of impact. Also, OVA screening of the open trench produced readings at background levels. Therefore, the results of the first sampling event indicate the southern extent of PNA impact and phenol impact terminates somewhere between Boring S-109 and Boring S-111.

3.1.4.2 Volatile Organic Compounds

The following samples were selected for VOCs and metals analysis in addition to SVOCs analysis: Samples S-2 and S-3 from Boring S-109 and Sample S-3 from Boring S-110. Compounds detected in more than one sample are presented in the order given above for the samples. The VOCs results are summarized in Table 2.

Methylene chloride and acetone were detected in all three samples. However, these compounds were also detected in the associated laboratory blanks indicating laboratory contamination. Benzene was found in the deep samples of both borings at 14 parts per billion (ppb) and 16 ppb. Toluene was detected in all three samples at 3.0 ppb (estimated), 9.0 ppb, and 5.0 ppb (estimated). Two other compounds were estimated at concentrations below the quantification limit in samples from Boring S-109. The

compounds were chloroform at 2.0 ppb in Sample S-2 and tetrachloroethane at 3.0 ppb in Sample S-3.

3.1.4.3 Priority Pollutant Metals

Priority pollutant metals analyses were performed on the same samples that were subjected to VOC analysis. Results were similar for all samples with Sample S-3 of Boring S-110 containing the highest concentrations of the three for almost all of the metals. The results are summarized in Table 2.

3.2 Bulkhead Wall Trench Samples

Final results for the bulkhead wall trench samples were received on December 22, 1990. Four of the six samples were taken from locations of darkened soils suggesting possible impact. The other two samples were taken from a trench in the southern portion of Area C which became part of the "construction area" when the southern wall location was moved 20 feet south. Each group of samples will be discussed separately. The samples were designated NSWT S-1 through NSWT S-6, and the results are summarized in Table 1.

3.2.1 Original Bulkhead Alignment Trench Samples

Samples S-1 through S-4 were taken from the trench excavated along the originally proposed line for the south bulkhead wall. Samples S-1 and S-2 contained only trace totals of non-carcinogenic PNAs at 2.5 ppm and 0.04 ppm, respectively. No carcinogenic PNAs were detected. The other two samples were taken at the west edge of the distinctly discolored soils area found under the concrete pad. The soils appeared clean to the west and impacted to the east at that point. Sample S-3 was taken from the discolored area, and Sample S-4 was taken from the normal area no more than one foot from Sample S-3. Sample S-4 contained no carcinogenic PNAs and only 0.10 ppm total

non-carcinogenic PNAs. On the other hand, Sample S-3 contained high levels of carcinogenic (169 ppm) and non-carcinogenic PNAs (155.6), respectively. These results confirmed the assumption that the visible interface represented a distinct barrier between designated and non-designated soils.

3.2.2 Final Bulkhead Alignment Trench Samples

Samples S-5 and S-6 were taken from the trench excavated along the final line for the south bulkhead wall. No SVOCs were detected in Sample S-5. Sample S-6 contained carcinogenic PNAs at 5.7 ppm and non-carcinogenic PNAs at 5.8 ppm.

3.3 Second Sampling Event

Final results from the second sampling event were received on January 22, 1991. The results are summarized in Table 1. Soils in two areas were sampled. Those areas were the New Slip 100-foot extension area and east of Larsen's In-Out building. Each area will be discussed separately. For purposes of discussion, "shallow" will be used to indicate the five-foot sampling depth, "middle" will be used to indicate the 15-foot sampling depth, and "deep" will be used to indicate the 24-foot sampling depth.

3.3.1 Slip Extension Area Samples

Borings S-114 and S-115 were drilled at the south and north ends of the zone between the east end of the 100-foot slip extension and the slurry wall. Results for the middle and deep samples from both borings were similar. The middle samples both contained only naphthalene at 0.67 ppm and 0.49 ppm, respectively. The deep samples contained total phenol concentrations of 23.8 ppm and 52.9 ppm, respectively. No carcinogenic PNAs were detected in the middle or deep samples. The shallow sample from Boring S-115 contained no detectable SVOCs. However, the shallow sample from Boring S-114, drilled at the south end of the area, contained both carcinogenic and non-

carcinogenic PNAs. The concentrations were 2.1 ppm and 11.5 ppm, respectively. Boring S-114 was located near the estimated perimeter of the impacted zone designated as Area B in the Design and Analysis Report, Waukegan Harbor Remediation.

Trench Samples SEET S-1 and SEET S-2 were taken from the north and south ends of an east-west trench excavated to the water table 25 feet west of the extended slip's eastern edge. Non-carcinogenic PNAs were detected at 1.1 ppm and carcinogenic PNAs were detected at 2.4 ppm in Sample S-1. Non-carcinogenic PNAs were detected at 0.27 ppm and carcinogenic PNAs were detected at 0.30 ppm in Sample S-2. All of the carcinogenic PNA detects were estimates below the quantification limits except for chrysene at 0.40 ppm in Sample S-1.

3.3.2 Larsen Marine Property Samples

As part of the agreement between Larsen and Outboard Marine Corporation (OMC), Borings S-116 and S-117 were drilled east of Larsen's In-Out building. All of the samples from Boring S-116 contained carcinogenic PNAs. The shallow, middle, and deep samples had concentrations of 4.0 ppm, 1.4 ppm and 0.06 ppm, respectively. Total non-carcinogenic PNAs were found at 4.4 ppm, 1.2 ppm, and 0.1 ppm. Total phenols were found at trace concentrations in the shallow and middle samples while the deep sample contained 15.8 ppm. The shallow and middle samples from Boring S-117 essentially had no detectable compounds. The deep sample contained 7.7 ppm of total phenols.

3.4 Anchor Wall Trench Sample

Final results for Sample STBT S-1 were received on January 28, 1991 and are summarized in Table 1. As expected, the sample contained high levels of both carcinogenic and non-carcinogenic PNAs. The concentrations were 229.8 ppm and 579.9 ppm, respectively. Thus, the area was considered to consist of designated material.

4.0 DESIGNATED SOILS CHRONOLOGY

The following section of the report will present a chronology of the sampling events. It will begin with receipt of results from the first sampling event and continue through the final excavation of designated soils. This history of events will include landmark decisions and an explanation for those decisions where applicable. All applicable correspondence referenced in the history is attached as Appendix B.

4.1 Proposal to Redefine Limits of Designated Soils

On December 21, 1990 after results from the first sampling event had been reviewed, a proposal was submitted to the United States Environmental Protection Agency (EPA) for redefinition of the designated soils limits. The content of the proposal was threefold. First, Area C soils would be considered non-designated soils based on the results from Borings S-105 through S-108. Second, within the boundaries of Area A, designated soils would be excavated to a depth of 10 feet north of the bulkhead wall and to a depth of 12 feet between the bulkhead wall and anchor wall. Results from Borings S-103 and S-104 indicated that the vertical extent of carcinogenic PNAs above 6.0 ppm in Area A was somewhere between five and 12 feet. Finally, the eastern limits of Area A north of the bulkhead wall would be extended to include impacted soils under the concrete slab discovered during trenching along the original bulkhead wall alignment. Preliminary results for Sample NSWT S-3 results confirmed the classification of those soils.

4.2 Response to Redefinition Proposal

On January 18, 1991, a conference call involving the EPA, the Illinois Environmental Protection Agency (IEPA), OMC, and Canonie was held to discuss the redefinition proposal. In the time between the submittal date and the conference call date, final results for Samples NSWT S-5 and NSWT S-6 were received. Data for these samples were not available at the time of the proposal.

The EPA agreed that Area C generally appeared free of impacted soil. However, Sample NSWT S-6, taken from a trench within Area C, contained a total carcinogenic PNA concentration of 5.7 ppm. This sample was approximately 20 feet west of the western boundary of Area A. In conjunction with the results submitted for NSWT S-3, the EPA offered an alternate definition of the areal limits of designated soils: a semi-circle (north of the anchor sheeting) encompassing NSWT S-3, Boring S-103, and NSWT S-6 at its perimeter. It should be noted that the original submittal of NSWT sampling information to the EPA had inadvertently shown the locations of Samples NSWT S-3 and NSWT S-4 interchanged. The EPA's definition was based on the heavily impacted sample (S-3) being to the west of the clean sample (S-4) indicating a possible connection between it and Area A. The opposite situation was correct; the impacted sample, and therefore the impacted soil, was to the east of the clean sample. This mistake was pointed out to the agencies immediately upon discovery.

A written response from the EPA dated January 24, 1991 confirmed the issues discussed during the conference call of January 18. Area C soils, with the exception of the soils surrounding Sample NSWT S-6, were considered to be non-designated soils. The definition of Area A as presented in the proposal, however, was not agreeable to the agency since the bottom elevation of the designated soils was undefined.

4.3 Basis for Third Sampling Event

The content of the third sampling event was also discussed during the January 18 conference call. The primary reason for proceeding with the sampling was accurate definition of the impacted zones which could not be mutually agreed upon with the accumulated data. A secondary reason was concern regarding the capacity of the designated soils stockpile because excavation operations had produced the unexpected discovery of new designated soils areas and further discoveries were probable based on the history of the site. After consideration of all data accumulated through mid-January 1991, the original Area A limits were believed too extensive. Three areas were

to be investigated during the third sampling event. First, sampling would occur in Area A between the bulkhead and anchor walls to determine the depth of impact. Second, shallow sampling would occur in Area A north of the bulkhead because data between the surface and 10 feet was not available for that area. Finally, sampling would occur east of Sample NSWT S-3 where the concrete pad and associated discolored soils were found.

4.4 Second Proposal of Excavation Limits

Shortly after receipt of results from the third sampling event, a second proposal for limits of excavation of designated soils was presented to the EPA, IEPA, and United States Army Corps of Engineers (ACE). A conference call was held on February 13, 1991 and included the above parties as well as OMC and Canonie.

The proposal involved four distinct areas of excavation presented on a sketched figure (included in Appendix B) which was telefaxed to all parties involved in the discussion. The following summarizes the proposed excavations.

1. Soils would be excavated to a depth of five feet for a 15-foot radius around Sample NSWT S-6. This area was later designated as Area 1.

2. Soils would be excavated to a minimum depth of five feet around Sample NSWT S-3 and Borings S-124 and S-125. The horizontal and vertical limits of excavation would be determined visually. This area was later designated as Area 2.

3. Soils would be excavated to a minimum depth of 10 feet around Sample STBT S-1 and the associated concrete rubble (Area 3 on Figure 4). As with Area 2, the limits of excavation would be determined visually.

4. Soils within Area A would be excavated to a depth of 15 feet well below a depth where soil may be a potential human contact or ingestion risk. The limits of excavation of Area A would be represented by the bulkhead and anchor walls to the north and south, respectively, the original eastern limit of Area A to the east, and a line perpendicular to the sheeting walls approximately midway between Borings S-52 and S-118 to the west.

4.5 Response to Second Proposal

The EPA agreed to the rationale used to determine the limits of Areas 1 through 3. However, the western limit of Area A was not agreed upon. And, more importantly, the proposed depth for Area A was rejected because the depth of impact had not been clearly defined. The deepest sample taken from Boring S-119 (10 feet to 12 feet) contained total carcinogenic PNAs well above the 6.0 ppm action level (77.1 ppm) as well as total non-carcinogenic PNAs above 200 ppm. The EPA rejected the 15-foot limit and ordered a deep, braced excavation with removal of all soil containing more than 6.0 ppm carcinogenic PNAs.

A written response from the EPA dated February 15, 1991 confirmed the issues discussed during the conference call of February 13. Excavation of Areas 1 through 3 as proposed could proceed. Area A required further definition (depth and west boundary). The letter also indicated the need for confirmation samples from Areas 2 and 3, which were to be excavated on a visual basis. The confirmation samples were taken as required after the field engineer determined the excavations were complete.

4.6 Third Proposal of Excavation Limits

During the monthly progress meeting held at the site on February 25, 1991, a third proposal for excavation was presented. Soils within Area A would be excavated to a depth of about 17 or 18 feet and then sampled to confirm removal of all designated

materials. If the sampling indicated further excavation was necessary, measures would be taken to excavate deeper and confirmation samples would again be obtained. The EPA rejected the proposal for several reasons. The most important were as follows. First, since the excavation would take place under water, there would be no way to substantiate the reliability of the sample because of soils sloughing from the sides and moving due to agitation by the excavator. Second, the use of confirmatory sampling directly contradicted the approved design/plan of defining the limits prior to excavation.

4.7 Fourth Proposal of Excavation Limits

Therefore, the fourth sampling event was devised and accepted during the meeting. Four deep borings, sampled regularly below 18 feet, would be drilled within Area A between the bulkhead and anchor walls. Two borings would be drilled north of the bulkhead wall to investigate a potential impacted area discovered while vibrating the anchor wall sheeting (part of the New Slip south wall) which comprised the southern boundary of Area A.

Upon receipt of preliminary results from the fourth sampling event, a fourth proposal for limits of excavation was presented. The presentation was made during a conference call on March 18, 1991. Sketches (included in Appendix B) of the proposed limits were provided to all parties. Immediately north of the bulkhead wall and immediately west of the job, an area approximately 25 feet wide by 40 feet long would be excavated to a depth of eight feet (this area will be referred to as Area N for purposes of discussion). A 15-foot-wide area between the bulkhead and anchor walls just east of the western row of temporary sheeting (near Boring S-118) would be excavated to a depth of 15 feet. When that excavation was completed, the temporary sheeting would be removed and redriven 15 feet to the east forming a 30-foot-wide by 45-foot-long area, the Area A temporary cell. This resultant cell would be braced and excavated to the hard clay interface, a depth of about 27 feet.

4.8 Response to Fourth Proposal

All parties agreed on March 18 to the limits and methods of excavation presented. This concurrence marked the end of discussions concerning the limits of excavation of designated soils. Plans were immediately made to excavate the soils that would not require bracing and mobilize necessary equipment and material for the Area A temporary cell bracing construction. The soils were excavated and placed in the containment cell between March 19 and April 2, 1991. Final capping of the designated soils stockpile occurred on April 26, 1991.

5.0 DESIGNATED SOILS EXCAVATION AND CONTAINMENT

The designated soils containment plan was described in Appendix N, "Design Brief, New Slip Area, Temporary Designated Soil Stockpile," of the "Remedial Action Plans, Design and Analysis Report, Waukegan Harbor Superfund Site," (Appendix N). The purpose of the containment cell design was to provide a temporary storage area for the designated soils until a remedial action is selected for the former coke oven property. Until such time, the stockpile would remain secured.

The following sections will present the important events and dates associated with the construction of the designated soils stockpile and the excavation of designated soils. The list will be ordered chronologically.

5.1 Designated Soils Stockpile Design

The designated soils stockpile was designed in accordance with the concepts embodied in Subpart L of Part 264 of the Federal Code of Regulations "Design Criteria for Waste Piles." The stockpile was sized to contain approximately 2,500 cubic yards of material with final side slopes of four horizontal to one vertical. The designed boundaries of the stockpile were limited by the site topography and the Waukegan Superfund Site boundary. An estimated 2,000 cubic yards of material was expected to be removed from Areas A and C as stated in Appendix N. If the actual volume of designated soils exceeded the estimate, the height of the stockpile could be expanded to handle the extra material. The as-built limits of the stockpile are shown on Figure 1.

5.2 Bottom Liner Construction

The berms and subgrade of the stockpile were formed by using sand from the north end of the sand pile that was removed to allow access for sampling. The final subgrade was between one-half-foot and one-foot thick. The berms were built approximately five feet

high, one foot higher than designed. Construction of the berms and subgrade began on November 20, 1990 and ended December 4, 1990. Installation of the 40-mil HDPE liner began on December 7 and was completed December 11. The concrete manhole was placed in the sump on the same day. The drainage pipe was installed the morning of December 12.

5.3 Containment of Trenching Soils

On December 11, Canonie began placement of trenching soils into the designated soils stockpile. These soils were generated from the shallow trenches dug to remove shallow obstructions from the bulkhead wall driving lines. The excavations began December 5 and ended December 10. The materials were cast alongside the trenches. Placement occurred on December 11. Material from within the boundaries of Area A and suspect material (discolored soils with the appearance of possible impact) from Area C were placed in the containment cell.

Approximately 360 total cubic yards of materials were placed in the cell. Of this total, an estimated 230 cubic yards originated from Area C. The soils were placed to the far east and west sides of the stockpile because the drainage pipe had not been installed at the time. Analytical results from the first sampling event, received several days after the materials were put in the stockpile, indicated that soils from Area C did not meet the criteria for designated soil. Although the Area A and Area C trenching soils were generally segregated within the cell, no attempt was made to remove the Area C soils because their appearance had led to their placement in the stockpile.

5.4 Stockpile Repairs

On December 15, 1990 and December 17, 1990, a combined total of nearly four tenths of an inch of precipitation fell at the site. From the accumulated water in the soils stockpile, two problems with drainage were evident. First, the drainage pipe appeared

to be bowed upward near the middle of the stockpile with water accumulated at its north end, indicating a problem with the subgrade elevation. It was either too high near the middle or too low to the north. Second, water had accumulated in the southwest corner of the stockpile, indicating a subgrade depression in that area.

The first problem was remedied by breaking up and removing ice that had formed under the drainage pipe and forced the bowing. The second problem was remedied by clearing the area of the collected ice, placing and grading clean sand in the southwest corner, and fusion-welding a 40-mil HDPE "patch" over the graded sand. Preparation for the patch occurred on January 14, 1991, and the patch was installed on January 15.

5.5 Excavation of Areas 1 Through 3

On February 14 and 15, 1991, after the conference call of February 13 (discussed in Sections 4.4 and 4.5 above), excavation and containment of designated soils from Areas 1 through 3 occurred. The three areas are shown on Figure 4. Soils within a 15-foot radius of Sample NSWT S-6 (Area 1) were dug to a depth of five feet and placed in the stockpile. Area 2 was excavated to an average depth of five feet. As proposed, the excavation was about 20 feet wide by 32 feet long. No visual evidence was found to justify extension of the proposed limits. Area 3 was excavated to a depth of about 10 feet. The actual limits of excavation were slightly larger than the proposed 15 feet by 27 feet, by about two feet for each dimension. The volume removed from each area was estimated at 133 cubic yards (Area 1), 120 cubic yards (Area 2), and 183 cubic yards (Area 3) for a total of 436 cubic yards.

5.6 Excavation of Areas A and N

On March 19, 1991, after the conference call of March 18 (discussed in Sections 4.7 and 4.8 above), excavation of the western portion of Area A and the upper three feet of Area N occurred. Area N is shown on Figure 5. The remainder of Area N was

excavated on March 20. The areas are shown on Figure 5. The ACE on-site representative observed the excavations and verified the completion depths. Soils between the bulkhead and anchor walls immediately east of the west temporary sheeting were removed to a depth of 15 feet as proposed. The soils of Area N were excavated to an average depth of about nine feet, slightly deeper than proposed. Volume removed from each area was estimated at 250 cubic yards (Area A) and 220 yards (Area N) for a total of 470 cubic yards. The total for Area N takes into account the portion of Area 2 overlapping Area N which had previously been excavated.

5.7 Area A Temporary Cell Bracing

After the western portion of Area A had been excavated, the temporary sheeting was removed and redriven 15 feet to the east to form a 45-foot by 30-foot cell between the bulkhead and anchor walls. In order to excavate materials to the hard clay interface, the temporary cell had to be braced for support because the sheeting already in place had only a minimal toe into the clay. This construction started on March 21, 1991 and ended March 29, 1991. The bracing consisted of heavy H-piles driven into the clay on the inside faces of the cell. Also, wales and corner bracing were welded to the inside faces about five feet below the top of sheets.

5.8 Excavation of Area A Temporary Cell

Following the completion of bracing, the soils within the temporary cell were excavated (Figure 5). The operation started on March 30, 1991 and ended April 2, 1991. A long-stick backhoe was used to remove the upper 15 feet of material and a clamshell bucket was used to remove the remaining material to the hard clay interface. The ACE on-site representative observed the excavation and verified the depth. Soils volume removed from the area was estimated to be 1,350 cubic yards.

Backfilling of the temporary cell began immediately after the verification of proper excavation and concluded on April 3. The backfill level was brought up to ground water level and suspended at that point for future installation of tie rods. The bracing and H-piles were removed beginning April 3 and ending April 10.

5.9 Total Volume of Designated Soils

The total estimated volume of designated soils placed in the stockpile was about 2,600 cubic yards. A summary of volumes taken from each excavation area is presented in Table 3. Since the berms were actually built about one foot higher than designed, more capacity was available than originally planned. Therefore, the volume placed in the containment cell when graded allowed for gradual sloping from the center point to the berms.

5.10 Top Liner Construction

A temporary plastic cover was placed over the soils in the stockpile on April 7, 1991 to prevent the designated materials from being blown away by strong winds. The temporary plastic was removed on April 12 to allow for rough grading of the soils and replaced the same day. Final grading of the soils occurred on April 22 in preparation for the top liner. The plastic cover remained on the stockpile and was utilized as a barrier between the designated soils and the 40-mil HDPE. Installation of the HDPE liner began April 24 and ended April 26. Final anchoring was completed April 29.

5.11 Perimeter Fence Installation

A six-foot-high gated, chain-link fence was erected around the perimeter of the stockpile for security. The installation began May 29, 1991 and ended June 5. Sufficient space for a vehicle was allowed between the toe of the berm and the fence. Site personnel will be required to gain access to the stockpile on a regular basis to monitor the water level in the manhole.

6.0 STOCKPILE UNDERDRAIN WATER

The designated soils stockpile remained open to the elements all winter as a resolution to the issue of excavation limits was delayed. This, in conjunction with a revised approach to handling saturated soils, resulted in a large volume of water collecting in the containment cell. The original plan for containing designated soils allowed for the excavated materials to be drained adjacent to the excavation area. However, the scope of work changed and this approach was abandoned. In any event, the actual amount of water in the containment cell became significantly greater than what was initially anticipated.

The following portion of the report chronicles the events related to the handling of the designated soils stockpile underdrain water.

6.1 Water Level

As the containment cell remained open and more materials were added to it, the water level continued to rise. The level became a critical issue by mid-March when the excavation limits of Area A were finally defined. The majority of the excavated materials would be saturated and no drainage prior to containment was possible. In order for all of the Area A soils to be placed in the stockpile, much of the water had to be removed.

6.2 Manhole Sample

A water sample was taken from the stockpile manhole on March 20, 1991. It was decided that potential disposal of the underdrain water would require analytical backup. The sample, designated as MH032091, was submitted for VOCs and SVOCs analysis.

Results were received on March 25 and are summarized in Table 4. Out of the two analyses, only six compounds were discovered above the quantification limits. The

levels of these compounds were very low. The compounds were methylene chloride (22 ppb), toluene (180 ppb), acenaphthene (57 ppb), dibenzofuran (22 ppb), fluorene (29 ppb), and bis (2-ethylhexyl) phthalate (14 ppb).

6.3 North Shore Sanitary District

As indicated in Appendix N, discharge to the North Shore Sanitary District (NSSD) was considered the desirable disposal option. The sample results were submitted to NSSD representatives on March 26, 1991. A meeting was scheduled and held on April 2 to discuss the potential discharge of the stockpile water to the NSSD sewer system. A brief background of the site was presented, and the source materials were identified. Furthermore, the detected compounds were reviewed and potential loading rates on the system were presented. However, the NSSD declined to accept the water in a letter dated April 4, 1991. Therefore, other disposal options were pursued by Canonie.

6.4 Temporary Storage

On March 29, 1991, three fiberglass tanks from the water treatment plant stored on-site by Canonie were moved to the stockpile area. Also, a tanker trailer was procured from Mr. Frank, Inc. (Mr. Frank) for backup storage. About 12,000 gallons of underdrain water were pumped into the fiberglass tanks on that day. However, the water level in the cell continued to rise because the saturated soils continued to drain. The clarifier and sludge tank from the water treatment system were moved to the area and used as temporary storage. On April 3, the various storage containers contained a total of about 32,000 gallons.

However, the pumping and storing effort was not making a significant impact on the cell water level, which remained near the top of the berms. Consequently, grading the soils in preparation for the top liner was impossible with the amount of water present.

Therefore, three more tanker trailers were leased from Mr. Frank to provide extra storage capacity.

6.5 Carbon Adsorption Treatment Proposal

On April 9, 1991, Canonie submitted a proposal to the EPA and IEPA for treatment of the designated soils stockpile underdrain water. The proposed treatment consisted of pumping the water through two Calgon Disposorb carbon adsorption units aligned in series and discharging the treated water into the New Slip. The flow rate for the treatment process would not exceed 15 gallons per minute (gpm). Sampling would occur once per 25,000 gallons treated. Also, a sample of the New Slip basin water would be obtained after the treatment was completed. Samples would be tested for VOCs, SVOCs, oil and grease, and total suspended solids.

6.6 Request to Transfer Water

On April 11, 1991, during a phone conversation with the EPA, Canonie requested permission to transfer water from the designated soils stockpile to OMC's tank farm located north of OMC's Plant No. 2. The transfer was necessary as an emergency measure. Heavy precipitation was predicted for the weekend of April 12 and the stockpile was already dangerously close to overflowing. The EPA agreed to allow the transfer during the discussion.

In a letter to the EPA dated April 12, Canonie documented the content of the April 11 phone conversation. Water from the designated soils stockpile would be transferred to the tank farm by Mr. Frank, a licensed special waste hauler. Prior to the move, the tank farm would be inspected to insure the integrity of the tanks and the proper function of the valves. After the move, the tank farm would be inspected daily.

6.7 Transfer of Water to OMC Tank Farm

On April 12, the temporary plastic cover was removed from the stockpile and water was removed. When an adequate volume of water had been pumped out of the cell, a bulldozer began sloping the soils. Seven 5,000-gallon tanker loads were hauled to the north property for a total of 35,000 gallons of which 32,000 gallons were taken directly from the cell. The final 3,000 gallons were removed from one of the temporary storage tanks near the stockpile to fill the last load. Each trip was properly manifested as the transfer of a special waste/non-hazardous waste.

On April 17, an additional 16,500 gallons were removed from the temporary storage tanks near the cell and taken to the tank farm. Three tanker loads of 5,500 gallons each were transferred. Again, each load was properly manifested. Canonie had originally planned to transfer all of the water remaining in the storage tanks to the tank farm. However, OMC suspended the operation after the third load, indicating that the maximum amount of storage available for the stockpile water was 50,000 gallons. In actuality, a total of 51,500 gallons were transferred to the tank farm and stored in four separate tanks. A summary of the transfer to the tank farm is listed in Table 5. The amount stored in each tank farm container is also listed in Table 5.

6.8 Approval of Treatment

The IEPA gave verbal approval to the proposed treatment and sampling on May 30, 1991. On June 3, request for approval was submitted to the EPA. The request restated the proposal and indicated that Canonie was prepared to begin treatment immediately. An anticipated duration for the treatment was seven days, assuming an average flow of 10 gpm and 24-hour operation. The EPA accepted the proposed treatment plan on June 4. In their acceptance of the plan, the agencies waived the necessity of toxicity testing on aquatic organisms because the closed New Slip basin was a sterile environment.

6.9 Underdrain Water Treatment

Treatment of the stored underdrain water began on the morning of June 5, 1991 and was completed on June 15. A summary of the volumes pumped through the carbon units is listed in Table 7. The flow rate during treatment varied between six gpm and 15 gpm. The system was backflushed several times in order to maintain the flow rate above 10 gpm. An estimated 98,380 gallons were treated during the 11-day period. Of this total, approximately 4,400 gallons were pumped from the stockpile manhole as it recharged at a rate of about 400 gallons per day. The discharge was sampled at least once every 25,000 gallons treated. A total of four samples were obtained. A summary is presented in Table 6.

6.10 Transfer of Tank Farm Water

In conjunction with the treatment operation, Mr. Frank was used to transfer the stored water from the tank farm to the treatment unit. Nine 5,500-gallon loads and one 2,000-gallon load were transferred over a five-day period which began on June 10, 1991. The same volume of water taken to the tank farm, 51,500 gallons, was returned to the stockpile area storage tanks for treatment. As before, all loads were properly manifested as a special waste/non-hazardous waste. A summary of the transfer from the tank farm is listed in Table 5.

6.11 Treatment Effluent Sample Results

Four effluent samples, designated as PNEF-E, PNEF-E2, PNEF-E3, and PNEF-E4, were taken during the treatment operation. The sample dates were June 6, June 10, June 12, and June 15, respectively. All samples were analyzed for VOCs, SVOCs, oil and grease, and total suspended solids. In addition, the third and fourth samples were analyzed for polychlorinated biphenyls (PCBs).

Applicable water quality criteria for the stockpile water were documented in a May 20, 1991 letter from the EPA. Preliminary results for the effluent samples were received on June 27, 1991. They are summarized in Table 4.

Of the four samples, only one (PNEF-E2) contained VOCs above the quantification limit. The compounds detected were benzene (71 ppb), toluene (52 ppb), and total xylenes (7 ppb). The applicable criteria for acute exposure for these compounds, as computed by the IEPA Industrial Permit Section, Division of Pollution Control (IPS-DPC), in accordance with the procedures outlined in the Illinois Water Pollution Control Rules, Title 35 (Illinois Title 35), Part 302, Subpart F, are 5.2 ppm (5,200 ppb), 1.75 ppm (1,750 ppb), and 1.5 ppm (1,500 ppb), respectively. The detected concentrations of these compounds were all well below the acute exposure criteria. Furthermore, the amounts were below chronic exposure criteria computed by IPS-DPC and documented in Canonie's May 8 review of Applicable or Relevant and Appropriate Requirements (ARARs).

Sample PNEF-E4 contained the only SVOC (phenol at 32 ppb) detected in any of the samples. The criteria set for phenol, based on Illinois Title 35, Subtitle C, Chapter 1, Subpart B: General Use Water Quality Standards, was 100 ppb. Therefore, the effluent water phenol concentration was below the applicable exposure criteria. The only other parameter found above the quantification limit was total suspended solids (13 ppm) in Sample PNEF-E3 at 13 ppm.

6.12 Proposal for Continued Treatment

On June 21, a proposal was submitted to the EPA requesting approval to treat underdrain water generated daily from the cell after the New Slip was opened. An estimated 10,000 gallons still remained in the stockpile after the treatment of the stored water. The treatment proposed was essentially the same as used for the stored water.

The water would be pumped through the same carbon units at a rate not to exceed 15 gpm and discharged into the New Slip. The only difference would be the sampling rate, which was proposed at once per 5,000 gallons treated. The same parameters would be analyzed.

This issue was raised during the June monthly meeting, held at the site on June 25. After discussion, the agencies verbally accepted the treatment of the remaining underdrain water as proposed. Canonie confirmed the verbal approval with a letter to the EPA dated July 11, 1991.

7.0 NEW SLIP BASIN WATER QUALITY

The New Slip basin was excavated by digging out soil from west to east leaving the Upper Harbor sheeting and a narrow sand berm in place during excavation. The slip was partially dewatered during excavation to reduce the intermixing of soil and water during the excavation. Water quality in the slip was monitored on request of the EPA on April 8, 1991 immediately after finishing excavation of Area A adjacent to the New Slip. A sample taken on April 19, 1991 and a second sample on April 30, 1991 showed steady improvement from the Area A excavation effects. Mr. Chris Kallis of the IEPA visited the site on May 22, 1991. Mr. Kallis noted that the water in the New Slip appeared acceptable.

The following portion of the report summarizes the sampling events and analytical results associated with the New Slip basin water.

7.1 Sample Identification

Samples taken prior to April 30, 1991 did not originally follow the sample labeling protocol set forth in Section 6.0 of the Remedial Action Quality Assurance Project Plan (RAQAPP). However, samples obtained on April 30 and after did follow the protocol. Therefore, in an effort to maintain consistency, the first samples were internally recoded to follow the protocol. The identifications generated by using the protocol (Sample I.D.) will be used in this report. All of the summary tables reference both the Sample Name (non-protocol designation) and the Sample I.D., where applicable.

The RAQAPP identification system assigns the sample code as follows:

nm-XXYYZZ-AAAA-b-c

Where: n = laboratory designation (first letter of lab name)

m = sample matrix (W = water, A = air, S = soil/sediment)

XX = month of year (i.e., 01 = January)

YY = day of month

ZZ = year (i.e., 90 = 1990)

AAAA = sample location code

b = sample type (I = influent, E = effluent, O = not appl.)

c = quality assurance designation (i.e., D = duplicate)

For instance, the water sample taken near the south end of the travel lift on April 8, originally coded as New Slip-1, was recoded as KW-040891-NS04-O. For purposes of discussion, the samples will be referenced by the four-character sample location code. When necessary, the full sample identification, less the separating dashes and the sample type, will be used to avoid confusion.

7.2 Agency Concern Over Water Quality

The EPA formally expressed concern over the New Slip water quality in a April 3, 1991 (mistakenly dated March 3, 1991) letter to the Trust. The concern voiced in the letter was based on a comparison between the appearance of the basin water and the harbor water. During a site visit on March 25, the EPA observed the difference in color between the two bodies of water and the formation of foam on the surface of the water. In fact, the basin water had a brownish-orange hue while the harbor water had a color indicative of lake water. The EPA also cited as an indication of water quality problems an odor noticed during the site visit throughout the New Slip area. The odor was most likely emanating from the open designated soils stockpile, which had received odoriferous designated soils from Area N and the western portion of Area A only five days prior to the EPA visit. The letter explicitly stated that the New Slip water be sampled immediately.

7.3 First Sampling Event

After receiving the letter, the Trust instructed Canonie to obtain a water sample. Canonie contacted the agencies and suggested using the analytical parameters required in Appendix M of the design and analysis report unless the agency had additional requirements. The IEPA requested that iron quantification be added to the analyses. The EPA requested that two samples be obtained from the Upper Harbor and two samples be obtained from the New Slip basin in order to compare the quality of each body. Also, the agencies asked that Canonie schedule the event so split-sampling could occur.

7.3.1 Water Sampling

On April 8, 1991, Canonie and the EPA sampling contractor both obtained two water samples from a depth of about 15 feet in the Upper Harbor (KW040891UH01O and

KW040891UH02) and two water samples (KW040891NS04O and KW040891NS05O) from a depth of about three feet in the New Slip basin. Sampling locations are shown on Figure 6 (See following section for explanation of sample location code). The samples were obtained using a stainless steel bailer rinsed first with hexane and then distilled water between each sampling location. Each sample was analyzed for VOCs, SVOCs, and metals (including iron). In addition to the above samples, Canonie obtained a sample of the sand foam/scum (KW040891NS02O) floating in the New Slip. No split was taken by the EPA. It should be noted that the New Slip samples were taken while the Area A temporary cell pile extraction operation was underway. The use of the vibratory hammer to remove the piles may have caused short-term impacts to the basin water quality.

Samples were stored and shipped in an iced cooler. All water and sediment samples associated with the New Slip and Upper Harbor were submitted to Kemron Environmental for analysis.

7.3.2 Results of First Sampling Event

Final results for the first sampling event were received May 9, 1991. They are summarized in Tables 7 through 9. Methylene chloride, benzene, toluene, and total xylenes were found in all of the samples in the general range of 10 ppb to 20 ppb. Both methylene chloride and toluene were also found in the laboratory blank. The Upper Harbor samples (Samples UH01 and UH02) contained slightly higher levels of benzene (14 ppb and 16 ppb) than the New Slip samples (from 8 to 10 ppb) and much higher levels of total xylenes (29 ppb and 36 ppb compared to a range of 3 to 5 ppb). On the other hand, two of the New Slip samples (Samples NS04 and NS05) contained acetone (19 ppb and 22 ppb) while the harbor samples did not.

Neither of the harbor samples had any detectable amounts of SVOCs. However, all of the New Slip samples contained total phenols (from 11.8 ppm to 20.6 ppm). Total non-

carcinogenic PNAs were also found in all three samples, ranging from 0.26 ppm to 1.29 ppm.

Concentrations of metals were not significant with the exception of arsenic. It was found in the three New Slip samples at 0.6 ppm to 0.7 ppm. Based on applicable water quality criteria, the primary compounds of concern were total phenols and arsenic.

7.4 Breach of New Slip Sand Plug

On the morning of April 9, 1991, after a heavy rainfall, the sand plug which separated the New Slip and the Upper Harbor was breached. The berm was repaired immediately, but a large volume of water flowed into the slip from the harbor. The water level within the slip rose approximately two feet due to the breach. However, the plug was repaired before the harbor and slip water levels reached an equilibrium. Therefore, no flow from the slip to the harbor occurred.

7.5 Second Sampling Event

A second sampling event of the New Slip water occurred on April 19, 1991. This event was performed for several reasons: concern over preliminary results from the first event, dilution caused by the plug breach, and the lack of pile driving or extraction operations as a potential cause of impact. Two water samples (KW-041991-NS04-O and KW-041991-NS05-O) were taken at the same locations within the New Slip basin as the first event samples (Figure 6). The samples were obtained by the same method described above and were submitted for SVOCs and arsenic analysis only. The other parameters were not requested because phenols and arsenic were of primary concern.

7.6 Results of Second Sampling Event

Final results from the second sampling event were received May 6, 1991 and are summarized in Tables 7 and 9. Both total phenols and arsenic concentrations were significantly lower than the concentrations found in the April 8 samples. Samples NS04 and NS05 contained total phenols at 1.66 ppm and 1.41 ppm, respectively. These values represented about a 90 percent decrease over the first samples. Arsenic concentrations, at 0.22 ppm and 0.21 ppm, respectively, were found to be about one third the first event results.

7.7 Third Sampling Event

The third sampling event was performed on April 25, 1991 by request of OMC. The event included one water sample from both the Upper Harbor (KW-042591-UH01-O) and the New Slip (KW-042591-NS04-O) and three sediment samples from the Upper Harbor along the east harbor wall (KS-042591-UH03-O, KS-042591-UH04-O, and KS-042591-UH05-O). The locations are shown on Figure 6. The sediment samples were obtained by using a stainless steel augering device which was cleaned between each location. The sediment samples were analyzed for VOCs, SVOCs, and metals. The water samples were analyzed only for cyanide.

7.8 Results of Third Sampling Event

Final results for the third sampling event were received on May 23, 1991. They are summarized in Tables 7 through 9. The three sediment samples contained methylene chloride at levels from 0.11 ppm to 0.17 ppm. Methylene chloride was also detected in the laboratory blank. Sample UH03 contained several other VOCs. The compounds were acetone (0.19 ppm), benzene (0.037 ppm), toluene (0.022 ppm), ethylbenzene (0.044 ppm), and total xylenes (0.13 ppm). Toluene was found in Sample UH05 at 0.015 ppm and 2-butanone was found in Sample UH04 at 0.029 ppm.

All of the sediment samples contained several PNAs. The levels in Sample UH05 were relatively low with a total PNA concentration of about 2.0 ppm. The PNA levels in Samples UH03 and UH04 were much higher. Carcinogenic PNAs were discovered at 2.3 ppm and 5.8 ppm, respectively. Non-carcinogenic PNAs were found at 17.3 ppm and 29.4 ppm, respectively. Sample UH03 also contained total phenols at approximately 15.6 ppm.

Arsenic was discovered in all three sediment samples. The concentrations were 13 ppm (UH03), 1.8 ppm (UH04), and 1.9 ppm (UH05). Sample UH03 also contained lead at 20 ppm and generally exhibited metals results much higher than the other two samples.

The cyanide results for the water samples indicated an insignificant difference between the New Slip water and the Upper Harbor water. Sample NS04 contained cyanide at 0.02 ppm while the compound was not detected in Sample UH01 at a quantification limit of 0.01 ppm.

7.9 Fourth Sampling Event

The fourth sampling event occurred on April 30, 1991. Its purpose was to fulfill the sampling requirements set forth in Appendix M of the Design Report. Appendix M called for three soil/sediment samples from the beach end (east end) of the New Slip (KS-043091-NS01-O, KS-043091-NS02-O, and KS-043091-NS03-O) and one slip water sample (KW-043091-NS04-O). The analytical parameters specified in Appendix M were VOCs, SVOCs, and metals. In addition, iron and cyanide were added to the target compound list. An additional sediment sample (KS-050291-NS04-O) was taken at location NS04 on May 2 because time constraints did not allow its collection on April 30. This sample was considered as part of the fourth event.

7.10 Results of Fourth Sampling Event

Preliminary results for the fourth sampling event were received on May 15, 1991 with final results for the fourth sampling event received on June 3, 1991. A summary of these results is presented in Tables 7 through 9. All of the sediment samples contained methylene chloride (ranging from 0.016 ppm to 0.22 ppm) and acetone (ranging from 0.042 ppm to 0.12 ppm). Sample NS01 contained the only other VOCs: 2-butanone at 0.032 ppm and toluene at 0.007 ppm. The water sample, Sample KW043091NS04, contained methylene chloride at 0.006 ppm and acetone at 0.025 ppm.

The three beach end sediment samples contained low concentrations of PNAs. The carcinogenic PNA levels ranged from 0.23 ppm to 0.45 ppm. The levels of non-carcinogenic PNAs ranged from 0.36 ppm to 1.2 ppm. Sample KS050291NS04, however, contained considerably higher levels with carcinogenic PNAs at 3.9 ppm and non-carcinogenic PNAs at 20.2 ppm. Total phenols were also found in this sample at a concentration of 0.68 ppm. The water sample had a total phenols concentration of 0.22 ppm.

Arsenic (from 2.3 ppm to 15 ppm), chromium (from 2 ppm to 5 ppm), iron (from 1,700 ppm to 3,600 ppm), lead (from 0.9 ppm to 2.5 ppm), nickel (from 2 ppm to 3 ppm), selenium (from 0.2 ppm to 0.4 ppm), and zinc (from 9.4 ppm to 22 ppm) were generally found in all of the sediment samples. As with SVOCs, Sample KS050291NS04 tended to contain the highest concentrations of each metal. Sample KW043091NS04 was found to contain arsenic (0.32 ppm), iron (0.61 ppm), selenium (0.008 ppm), and zinc (0.07 ppm).

Cyanide was not detected in any of the sediment samples. The water sample contained 0.02 ppm of cyanide.

7.11 Post-Treatment Basin Water Sample

On June 17, 1991, a final sample of the New Slip water was taken. This sample (KW-061791-NS04-O) was obtained in accordance with the treatment proposal for the designated soils stockpile underdrain water. It was analyzed for VOCs, SVOCs, PCBs, oil and grease, and total suspended solids. The only detectable compounds were 2-butanone (0.028 ppm) and bis (2-ethylhexyl) phthalate (0.013 ppm).

7.12 Review of ARARs for New Slip Water Quality

On May 8, 1991, Canonie submitted to the EPA a letter summarizing the findings of a review of ARARs for the New Slip water quality. At the time the letter was written, only the results from the first two sampling events were available. The letter stated that the only ARARs for the New Slip were the Illinois General Use Water Quality Standards. Specifically, phenols and arsenic were the parameters covered by these standards which were found in the first slip water samples. The concentrations for both compounds exceeded the general use water quality criteria of 0.36 ppm (acute exposure) and 0.19 ppm (chronic exposure) for arsenic and 0.1 ppm for phenols. The letter also cited other sources for criteria which might have been considered ARARs for opening the New Slip. Included in these sources were the values computed by the IEPA in accordance with Title 35, Subpart F, referenced previously in Section 6.11.

The letter suggested potential mechanisms for the decrease in arsenic and phenols concentrations between the first and second sampling events. The most obvious mechanism which may have caused a decrease was the failure of the sand plug discussed above in Section 7.3.2. The inflow of the large volume of water most likely led to the dilution in the New Slip. The decrease in phenol concentrations could be attributed to the fact that phenol is readily biodegradable. Possible mechanisms suggested for the decreased concentration of arsenic were biodegradation/volatilization and settling of suspended solids.

On June 20, 1991, OMC transmitted the results of two reports of laboratories on the floating foam found in the New Slip during construction activities. The letter (see Appendix B) also provided a reassessment report from Geraghty & Miller Engineers, Inc. (G&ME) on the expected ground water flow in the New Slip area with the slurry wall installed on the beach end of the New Slip. The analytical reports indicated that the foam was a polymeric compound containing primarily sand fines with some hydrocarbon residue. The G&ME report indicates that the 100-foot extended slip with slurry wall has a lower inflow of ground water to the New Slip than the summer 1990 design without a slurry wall.

The results from the second sampling event showed that the New Slip water quality was equal to or better than the Upper Harbor water quality for VOCs. Also, PNAs were below water quality criteria. Arsenic, at 0.22 ppm, was below the acute exposure standard of 0.36 ppm and substantially equivalent to the chronic exposure standard of 0.19 ppm. Only phenols, at approximately 1.5 ppm, were above the general use standard of 0.1 ppm. The letter predicted that a significant reduction in the phenols concentration might be noticed in the results for the fourth sampling event based on the decrease between the first and second sampling events.

In fact, the phenols concentration for the sample obtained on April 30 was 0.22 ppm, a decrease of about 85 percent. Therefore, the level still exceeded the General Use Water Quality Standard. However, no phenols were detected in the basin water sample taken on June 17 after the soils stockpile water treatment was completed.

7.13 Opening of New Slip

After review of the analytical data, the agency approved the opening of the New Slip on June 27, 1991. The agencies had previously acknowledged verbal acceptance during the June 25 monthly meeting. The agency acknowledged in the June 27, 1991 letter that the New Slip does not present an accute risk to human health and the environment.

After receiving the letter, Canonie proceeded with operations to open the New Slip to the Upper Harbor. Excavation of the sand plug began on June 28 and was completed on June 30. On July 1, a diving crew was brought on-site to cut the existing harbor sheeting at Elevation 570.0 United States Geological Survey. Instead of pulling the sheets, a decision was made to have them cut at the bottom grade of the New Slip to avoid any transfer of material across the mouth of the New Slip. On July 2, another diving crew was mobilized to accelerate the cutting process. The final sheets were removed on July 3, marking the substantial completion of the New Slip construction.

Table 1

SUMMARY SEMIVOLATILE ORGANICS RESULTS
NEW SLIP AREA SOIL

SAMPLE INFORMATION

Boring I.D.	S-101	S-101	S-101	S-101	S-102	S-102	S-102	S-102	S-103	S-104	S-105
Sample I.D.	S-1	S-2	S-3	S-3 DL	S-1	S-2	S-3	S-3 DL	S-A1	S-A1	S-A1
CompuChem I.D.	382883	382885	382886	382886	382891	382893	382894	382894	383097	383080	383763
Sample Depth (ft)	5.0-7.0	15.0-17.0	24.0-26.0	24.0-26.0	5.0-7.0	15.0-17.0	24.0-26.0	24.0-26.0	9.0-11.0	11.0-13.0	9.0-11.0
Sample Date	11/19/90	11/19/90	11/19/90	11/19/90	11/19/90	11/19/90	11/19/90	11/19/90	11/20/90	11/20/90	11/26/90

COMPOUNDS (ug/kg)

Phenol			57000	130000			40000	79000			
2-Methylphenol			12000	11000		57	8100	7400			
4-Methylphenol			34000	47000		52	30000	33000			
2,4-Dimethylphenol		440	5100	4300		350	3900	2700			
Benzoic Acid			320				310				
Naphthalene									4200	920	140
2-Methylnaphthalene									100	110	
Acenaphthylene	51									68	59
Acenaphthene	980				1100				1500	3600	680
Dibenzofuran									430	2000	1000
Fluorene					52				630	2700	630
Phenanathrene									1400	4800	
Anthracene									42	640	
Di-n-Butylphthalate	46	57	63		58	51	51				
Fluoranthene										1500	
Pyrene										1100	
Benzo (a) Anthracene [c]										430	
Chrysene [c]										500	
bis (2-Ethylhexyl) Phthalate											
Benzo (b) Fluoranthene [c]										58	
Benzo (k) Fluoranthene [c]										58	
Benzo (a) Pyrene [c]										45	
Indeno (1,2,3-cd) Pyrene [c]											
Dibenzo (a,h) Anthracene [c]											
Benzo (g,h,i) Perylene											

Total Phenols	0	440	108100	192300	0	459	82000	122100	0	0	0
Total Carc. PNAs	0	0	0	0	0	0	0	0	0	1091	0
Total Non-Carc. PNAs	1077	57	383	0	1210	51	361	0	8302	17438	2509
Total PNAs	1077	57	383	0	1210	51	361	0	8302	18529	2509

Table 1

SUMMARY SEMIVOLATILE ORGANICS RESULTS
NEW SLIP AREA SOIL
(continued)

SAMPLE INFORMATION											
Boring I.D.	S-105	S-105	S-106	S-106	S-107	S-107	S-108	S-108	S-108	S-109	S-109
Sample I.D.	S-6	S-6 DL	S-A1	S-6	S-A1	S-6	S-A1	S-6	S-6 DL	S-1	S-2
CompuChem I.D.	383770	383770	383383	383387	383758	383765	383388	383389	383389	382896	382898
Sample Depth (ft)	24.0-26.0	24.0-26.0	11.0-13.0	24.0-24.8	9.0-11.0	24.0-26.0	9.0-11.0	24.0-26.0	24.0-26.0	5.0-7.0	15.0-17.0
Sample Date	11/26/90	11/26/90	11/21/90	11/21/90	11/26/90	11/26/90	11/21/90	11/21/90	11/21/90	11/19/90	11/19/90
COMPOUNDS (ug/kg)											
Phenol				26000		140		15000	18000	1100	
2-Methylphenol	360	420		3700		430		5100	5200	45	
4-Methylphenol	8000	11000		20000		8300		36000	55000	290	
2,4-Dimethylphenol	4700	5000		2500		7300		9800	8700		
Benzoic Acid											
Naphthalene			10000	3200	1700		3300	86			540
2-Methylnaphthalene			4200				1300				
Acenaphthylene			130								
Acenaphthene			1500		2600		1200			480	
Dibenzofuran			850		1500		64				
Fluorene			920		510		230				
Phenanathrene											
Anthracene											
Di-n-Butylphthalate										65	60
Fluoranthene											
Pyrene											
Benzo (a) Anthracene [c]											
Chrysene [c]											
bis (2-Ethylhexyl) Phthalate	48						54				
Benzo (b) Fluoranthene [c]											
Benzo (k) Fluoranthene [c]											
Benzo (a) Pyrene [c]											
Indeno (1,2,3-cd) Pyrene [c]											
Dibenzo (a,h) Anthracene [c]											
Benzo (g,h,i) Perylene											
Total Phenols	13060	16420	0	52200	0	16170	0	64900	86900	1435	0
Total Carc. PNAs	0	0	0	0	0	0	0	0	0	0	0
Total Non-Carc. PNAs	48	0	17600	3200	6310	0	6148	86	0	545	600
Total PNAs	48	0	17600	3200	6310	0	6148	86	0	545	600

Table 1

SUMMARY SEMIVOLATILE ORGANICS RESULTS
NEW SLIP AREA SOIL
(continued)

SAMPLE INFORMATION											
Boring I.D.	S-109	S-109	S-110	S-110	S-110	S-110	S-111	S-111	S-111	S-112	S-112
Sample I.D.	S-3	S-3 DL	S-1	S-2	S-3	S-3 DL	S-1	S-2	S-3	S-1	S-2
CompuChem I.D.	382907	382907	382917	382918	382919	382907	383087	383091	383086	383089	383092
Sample Depth (ft)	24.0-26.0	24.0-26.0	5.0-7.0	15.0-17.0	24.0-26.0	24.0-26.0	5.0-7.0	15.0-17.0	24.0-26.0	5.0-7.0	15.0-17.0
Sample Date	11/19/90	11/19/90	11/19/90	11/19/90	11/19/90	11/19/90	11/20/90	11/20/90	11/20/90	11/20/90	11/20/90
COMPOUNDS (ug/kg)											
Phenol	**62000**	**170000**			**660**	720					
2-Methylphenol	**13000**	**14000**			**950**	930					
4-Methylphenol	**35000**	**60000**			**17000**	**26000**					
2,4-Dimethylphenol	**5700**	5100		69	**3000**	**2500**					
Benzoic Acid					100						
Naphthalene				**1400**							
2-Methylnaphthalene											
Acenaphthylene			64								
Acenaphthene			**1800**								
Dibenzofuran											
Fluorene			**650**								
Phenanathrene			65								
Anthracene			54								
Di-n-Butylphthalate	48		50	49	62						
Fluoranthene			**890**								
Pyrene			360								
Benzo (a) Anthracene [c]											
Chrysene [c]											
bis (2-Ethylhexyl) Phthalate										42	
Benzo (b) Fluoranthene [c]											
Benzo (k) Fluoranthene [c]											
Benzo (a) Pyrene [c]											
Indeno (1,2,3-cd) Pyrene [c]											
Dibenzo (a,h) Anthracene [c]											
Benzo (g,h,i) Perylene											
Total Phenols	115700	249100	0	69	21610	30150	0	0	0	0	0
Total Carc. PNAs	0	0	0	0	0	0	0	0	0	0	0
Total Non-Carc. PNAs	48	0	3933	1449	162	0	0	0	0	42	0
Total PNAs	48	0	3933	1449	162	0	0	0	0	42	0

Table 1

SUMMARY SEMIVOLATILE ORGANICS RESULTS
NEW SLIP AREA SOIL
(continued)

SAMPLE INFORMATION

Boring I.D.	S-112	S-114	S-114	S-114	S-114	S-115	S-115	S-115	S-115	S-116	S-116
Sample I.D.	S-3	S-1	S-2	S-3	S-3 DL	S-1	S-2	S-3	S-3 DL	S-1	S-2
CompuChem I.D.	383085	391398	391400	391402	391402	391399	391400	391406	391406	391609	391610
Sample Depth (ft)	24.0-26.0	5.0-7.0	15.0-17.0	25.0-27.0	25.0-27.0	5.0-7.0	15.0-17.0	25.0-27.0	25.0-27.0	5.0-7.0	15.0-16.5
Sample Date	11/20/90	1/3/91	1/3/91	1/3/91	1/3/91	1/3/91	1/3/91	1/3/91	1/3/91	1/4/91	1/4/91

COMPOUNDS (ug/kg)

Phenol				5300	7700			18000	33000	170	220
2-Methylphenol				1000	1300			3200	3500		120
4-Methylphenol				10000	12000			11000	15000	65	430
2,4-Dimethylphenol				2500	2800			1400	1400		89
Benzoic Acid											
Naphthalene		61	670				490	63			
2-Methylnaphthalene											
Acenaphthylene											
Acenaphthene		560									
Dibenzofuran		86									
Fluorene		1300									
Phenanathrene		900								280	120
Anthracene		290								740	130
Di-n-Butylphthalate											
Fluoranthene		4900								2200	520
Pyrene		3300								1100	380
Benzo (a) Anthracene [c]		380								760	280
Chrysene [c]		400								890	260
bis (2-Ethylhexyl) Phthalate			51	47							
Benzo (b) Fluoranthene [c]		530								920	340
Benzo (k) Fluoranthene [c]		530								920	340
Benzo (a) Pyrene [c]		220								350	140
Indeno (1,2,3-cd) Pyrene [c]		79								130	58
Dibenzo (a,h) Anthracene [c]											
Benzo (g,h,i) Perylene		100								120	

Total Phenols	0	0	0	18800	23800	0	0	33600	52900	235	859
Total Carc. PNAs	0	2139	0	0	0	0	0	0	0	3970	1418
Total Non-Carc. PNAs	0	11497	721	47	0	0	490	63	0	4440	1150
Total PNAs	0	13636	721	47	0	0	490	63	0	8410	2568

Table 1

SUMMARY SEMIVOLATILE ORGANICS RESULTS
NEW SLIP AREA SOIL
(continued)

SAMPLE INFORMATION											
Boring I.D.	S-116	S-116	S-117	S-117	S-117	S-118	S-118	S-118	S-118	S-119	S-119
Sample I.D.	S-3	S-3 DL	S-1	S-2	S-3	S-1	S-1 DL	S-2	S-3	S-1	S-1 DL
CompuChem I.D.	391611	391611	391612	391613	391614	395074	395074	395085	395083	395076	395076
Sample Depth (ft)	25.0-26.5	25.0-26.5	5.0-7.0	15.0-17.0	25.0-26.5	6.0-8.0	6.0-8.0	8.0-10.0	10.0-12.0	6.0-8.0	6.0-8.0
Sample Date	1/4/91	1/4/91	1/4/91	1/4/91	1/4/91	1/23/91	1/23/91	1/23/91	1/23/91	1/23/91	1/23/91
COMPOUNDS (ug/kg)											
Phenol	55			49							
2-Methylphenol	780	910			440						
4-Methylphenol	9300	11000			5500						
2,4-Dimethylphenol	3800	3900			1800						
Benzoic Acid						220				130	
Naphthalene						7400	6900	4600	4500	500	480
2-Methylnaphthalene						270	210	67		60	
Acenaphthylene						53		94		150	160
Acenaphthene						3600	3200	4900	3700	3100	2900
Dibenzofuran						4400	3900	1100	140	2800	2500
Fluorene						4100	3500	930	80	4600	4200
Phenanathrene						1200	1000	160	79	8400	8100
Anthracene						49				1900	2000
Di-n-Butylphthalate										52	100
Fluoranthene	68					100				5200	4800
Pyrene	61					76				3300	2900
Benzo (a) Anthracene [c]	60					52				1200	1000
Chrysene [c]										720	910
bis (2-Ethylhexyl) Phthalate				50		48					
Benzo (b) Fluoranthene [c]										980	910
Benzo (k) Fluoranthene [c]										980	910
Benzo (a) Pyrene [c]										530	490
Indeno (1,2,3-cd) Pyrene [c]										300	290
Dibenzo (a,h) Anthracene [c]										140	140
Benzo (g,h,i) Perylene										340	330
Total Phenols	13935	15810	0	49	7740	0	0	0	0	0	0
Total Carc. PNAs	60	0	0	0	0	52	0	0	0	4850	4650
Total Non-Carc. PNAs	129	0	0	50	0	21516	18710	11851	8499	30532	28470
Total PNAs	189	0	0	50	0	21568	18710	11851	8499	35382	33120

Table 1

SUMMARY SEMIVOLATILE ORGANICS RESULTS
NEW SLIP AREA SOIL
(continued)

SAMPLE INFORMATION											
Boring I.D.	S-119	S-119	S-119	S-119	S-120	S-121	S-122	S-123	S-124	S-125	S-126
Sample I.D.	S-2	S-2 DL	S-3	S-3 DL	S-1	S-1	S-1	S-1	S-1	S-1	S-1
CompuChem I.D.	395084	395084	395082	395082	395089	395086	395090	395088	395091	395071	395347
Sample Depth (ft)	8.0-10.0	8.0-10.0	10.0-12.0	10.0-12.0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0	5.0-6.5
Sample Date	1/23/91	1/23/91	1/23/91	1/23/91	1/23/91	1/23/91	1/23/91	1/23/91	1/23/91	1/23/91	1/24/91
COMPOUNDS (ug/kg)											
Phenol											
2-Methylphenol											
4-Methylphenol											
2,4-Dimethylphenol											
Benzoic Acid									53	150	
Naphthalene	470	490	1300		73					65	
2-Methylnaphthalene	57		85								
Acenaphthylene	180		820				44			46	470
Acenaphthene	5000	4800	7500	5900	690	670	1300	170	910	490	140
Dibenzofuran	3000	3100	2300	1800	610	94					
Fluorene	5200	5000	4100	3400	690	1100	1700	190	46	120	
Phenanathrene	13000	1300	40000	70000	690	180	130	50	110	140	
Anthracene	3300	3400	15000	21000	55	210	54		53	52	
Di-n-Butylphthalate						45					
Fluoranthene	6100	5700	33000	64000		1100	700	360	370	660	
Pyrene	4500	4400	33000	38000		480	230	190	260	340	
Benzo (a) Anthracene [c]	1300	1300	16000	14000							
Chrysene [c]	1200	1400	15000	17000							
bis (2-Ethylhexyl) Phthalate								48			
Benzo (b) Fluoranthene [c]	1300	1300	18000	16000				46			
Benzo (k) Fluoranthene [c]	1300	1300	18000	16000				46			
Benzo (a) Pyrene [c]	710	690	9000	8300							
Indeno (1,2,3-cd) Pyrene [c]	360	350	4800	4200							
Dibenzo (a,h) Anthracene [c]	150		1300	1600							
Benzo (g,h,i) Perylene	290	290	3600	3600							
Total Phenols	0	0	0	0	0	0	0	0	0	0	0
Total Carc. PNAs	6320	6340	82100	77100	0	0	0	92	0	0	0
Total Non-Carc. PNAs	41097	28480	140705	207700	2808	3879	4158	1008	1802	2063	610
Total PNAs	47417	34820	222805	284800	2808	3879	4158	1100	1802	2063	610

Table 1

SUMMARY SEMIVOLATILE ORGANICS RESULTS
NEW SLIP AREA SOIL
(continued)

SAMPLE INFORMATION											
Boring I.D.	S-127	S-127	S-127	S-132	S-132	S-132	S-132	S-133	S-133	S-133	S-133
Sample I.D.	S-1	S-2	S-3	S-1	S-1 DL	S-3	S-3 DL	S-1	S-1 DL	S-2	S-2 DL
CompuChem I.D.	395350	395351	395352	401562	401562	401564	401564	402041	402041	402048	402048
Sample Depth (ft)	5.0-6.5	15.0-16.5	25.0-26.5	18.0-20.0	18.0-20.0	24.0-26.0	24.0-26.0	18.0-20.0	18.0-20.0	21.0-23.0	21.0-23.0
Sample Date	1/24/91	1/24/91	1/24/91	2/26/91	2/26/91	2/26/91	2/26/91	2/27/91	2/27/91	2/27/91	2/27/91
COMPOUNDS (ug/kg)											
Phenol	1100		41000	44000	44000	22000	44000	16000	15000	39000	24000
2-Methylphenol	120		5100	5100	4500	4700	4000			5000	2700
4-Methylphenol	390		39000	21000	20000	13000	18000	5100	5000	17000	10000
2,4-Dimethylphenol		46	4000	2200	1800	2100	1300			1800	1000
Benzoic Acid											
Naphthalene				910	800	3100	3600	16000	15000	13000	9000
2-Methylnaphthalene								3000		2000	1200
Acenaphthylene	1000							980		1000	
Acenaphthene	340					39		47000	39000	20000	14000
Dibenzofuran								47000	36000	21000	14000
Fluorene								110000	66000	39000	28000
Phenanathrene								350000	180000	120000	110000
Anthracene								160000	89000	46000	36000
Di-n-Butylphthalate											
Fluoranthene								160000	100000	93000	75000
Pyrene								92000	72000	68000	52000
Benzo (a) Anthracene [c]								34000	23000	23000	17000
Chrysene [c]								33000	23000	22000	17000
bis (2-Ethylhexyl) Phthalate											
Benzo (b) Fluoranthene [c]								36000	16000	27000	15000
Benzo (k) Fluoranthene [c]								36000	16000	27000	4800
Benzo (a) Pyrene [c]								17000	6700	12000	8700
Indeno (1,2,3-cd) Pyrene [c]								6000		3900	
Dibenzo (a,h) Anthracene [c]								880			
Benzo (g,h,i) Perylene								6100			
Total Phenols	1610	46	89100	72300	70300	41800	67300	21100	20000	62800	37700
Total Carc. PNAs	0	0	0	0	0	0	0	162880	84700	114900	62500
Total Non-Carc. PNAs	1340	0	0	910	800	3139	3600	1022080	597000	423000	339200
Total PNAs	1340	0	0	910	800	3139	3600	1184960	681700	537900	401700

Table 1

SUMMARY SEMIVOLATILE ORGANICS RESULTS
NEW SLIP AREA SOIL
(continued)

SAMPLE INFORMATION											
Boring I.D.	S-133	S-134	S-135	S-135	S-136	S-136	S-136	S-137	NSWT	NSWT	NSWT
Sample I.D.	S-3	S-1	S-1	S-1 DL	S-1	S-1 DL	S-2	S-1	S-1	S-2	S-3
CompuChem I.D.	402050	402033	402036	402036	402024	402024	402026	402029	386708	386709	386713
Sample Depth (ft)	24.0-26.0	18.0-20.0	18.0-20.0	18.0-20.0	5.0-7.0	5.0-7.0	7.0-9.0	5.0-7.0	5.0	5.0	2.5
Sample Date	2/27/91	2/27/91	2/27/91	2/27/91	2/27/91	2/27/91	2/27/91	2/27/91	12/6/90	12/6/90	12/6/90
COMPOUNDS (ug/kg)											
Phenol	39000	9600	39000	110000							
2-Methylphenol	3400	670	10000	13000							
4-Methylphenol	14000	3500	40000	41000							
2,4-Dimethylphenol	1100	240	5200	4100							
Benzoic Acid							43			40	210
Naphthalene	4200	6900	2500	3600	17000	27000	160				3200
2-Methylnaphthalene	570	880			8000	11000					1900
Acenaphthylene	220	130			2800	7200		160			3200
Acenaphthene	9800	2900			41000	52000	2000	2500	1500		1300
Dibenzofuran	10000	2300			26000	34000	95	100			1500
Fluorene	19000	3500			63000	66000	110	1000	930		240
Phenanathrene	70000	11000	86		250000	220000	220	290	60		12000
Anthracene	19000	1800	60		80000	90000	96	410			3800
Di-n-Butylphthalate											
Fluoranthene	26000	5400	63		320000	250000	210	200			52000
Pyrene	17000	3700	58		190000	160000	140	170			37000
Benzo (a) Anthracene [c]	6100	1400			61000	78000	54	63			20000
Chrysene [c]	5700	1300			53000	79000	63	47			24000
bis (2-Ethylhexyl) Phthalate					4200	13000	64	93			
Benzo (b) Fluoranthene [c]	3800	1600			73000	120000	58	85			35000
Benzo (k) Fluoranthene [c]		1600			73000	120000	58	85			35000
Benzo (a) Pyrene [c]	3000	690			32000	38000		43			15000
Indeno (1,2,3-cd) Pyrene [c]					15000	11000					7300
Dibenzo (a,h) Anthracene [c]					4800						2600
Benzo (g,h,i) Perylene					15000	11000					7400
Total Phenols	57500	14010	94200	168100	0	0	0	0	0	0	0
Total Carc. PNAs	18600	6590	0	0	311800	446000	233	323	0	0	138900
Total Non-Carc. PNAs	175790	40510	2767	3600	1027000	941200	3138	4923	2490	40	123750
Total PNAs	194390	47100	2767	3600	1338800	1387200	3371	5246	2490	40	262650

Table 1

SUMMARY SEMIVOLATILE ORGANICS RESULTS
NEW SLIP AREA SOIL
(continued)

SAMPLE INFORMATION											
Boring I.D.			NSWT	NSWT	NSWT	NSWT	SEET	SEET	STBT		
Sample I.D.			S-3 DL	S-4	S-5	S-6	S-1	S-2	S-1		
CompuChem I.D.			386713	386714	387954	387955	391607	391608	393693		
Sample Depth (ft)			2.5	2.5	5.0	4.0	4.0	4.0	3.0		
Sample Date			12/6/90	12/6/90	12/11/90	12/11/90	1/4/91	33242	33254		
COMPOUNDS (ug/kg)											
Phenol											
2-Methylphenol											
4-Methylphenol											
2,4-Dimethylphenol											
Benzoic Acid											
Naphthalene			3600			120			50000		
2-Methylnaphthalene			2000			75			13000		
Acenaphthylene			2700			140			2800		
Acenaphthene			1700	60		140			34000		
Dibenzofuran			1800			110			29000		
Fluorene			1200			110			42000		
Phenanathrene			15000			630	110	48	150000		
Anthracene			3800			290			39000		
Di-n-Butylphthalate											
Fluoranthene			63000			2300	570	100	110000		
Pyrene			51000	39		1500	510	120	94000		
Benzo (a) Anthracene [c]			26000			890	190	63	43000		
Chrysene [c]			29000			880	400	68	33000		
bis (2-Ethylhexyl) Phthalate											
Benzo (b) Fluoranthene [c]			42000			1400	650	84	55000		
Benzo (k) Fluoranthene [c]			42000			1400	650	84	55000		
Benzo (a) Pyrene [c]			18000			650	230		27000		
Indeno (1,2,3-cd) Pyrene [c]			9000			330	140		12000		
Dibenzo (a,h) Anthracene [c]			3000			120			4800		
Benzo (g,h,i) Perylene			9800			340	130		13000		

Total Phenols	0	0	0	0	0	0	0
Total Carc. PNAs	169000	0	0	5670	2260	299	229800
Total Non-Carc. PNAs	155600	99	0	5755	1320	268	576800
Total PNAs	324600	99	0	11425	3580	567	806600

Table 1

SUMMARY SEMIVOLATILE ORGANICS RESULTS
NEW SLIP AREA SOIL
FIELD REPLICATES
(continued)

SAMPLE INFORMATION											
Field Replicate I.D.			FR-1	FR-2	FR-3	FR-3 DL	FR-4	FR-5			
Boring I.D.			S-112	S-111	S-108	S-108	S-105	S-105			
Sample I.D.			S-1	S-1	S-A1	S-A1	S-A1	S-6			
CompuChem I.D.			383093	383090	383390	383390	383771	383772			
Sample Depth (ft)			5.0-7.0	5.0-7.0	9.0-11.0	9.0-11.0	9.0-11.0	24.0-26.0			
Sample Date			11/20/91	11/20/91	11/21/91	11/21/91	11/26/91	11/26/91			
COMPOUNDS (ug/kg)											
Phenol											
2-Methylphenol								350			
4-Methylphenol								6500			
2,4-Dimethylphenol								4700			
Benzoic Acid					42						
Naphthalene					28000	70000	55				
2-Methylnaphthalene					590	1600					
Acenaphthylene					140		190				
Acenaphthene					10000	7700	1800				
Dibenzofuran					7500	5400	1500				
Fluorene					3900	2300	340				
Phenanathrene					63						
Anthracene					47						
Di-n-Butylphthalate											
Fluoranthene											
Pyrene											
Benzo (a) Anthracene [c]											
Chrysene [c]											
bis (2-Ethylhexyl) Phthalate							72	61			
Benzo (b) Fluoranthene [c]											
Benzo (k) Fluoranthene [c]											
Benzo (a) Pyrene [c]											
Indeno (1,2,3-cd) Pyrene [c]											
Dibenzo (a,h) Anthracene [c]											
Benzo (g,h,i) Perylene											

Total Phenols	0	0	0	0	0	11550
Total Carc. PNAs	0	0	0	0	0	0
Total Non-Carc. PNAs	0	0	50282	87000	3957	61
Total PNAs	0	0	50282	87000	3957	61

Table 1

SUMMARY SEMIVOLATILE ORGANICS RESULTS
NEW SLIP AREA SOIL
(continued)

NOTES:

1. All results presented in micrograms per kilogram or parts per billion.
2. Semivolatile compounds not listed were not detected in any sample.
3. Results presented in boldface were detected above the quantification limit.
4. Results presented in normal typeface were detected below the quantification limit and estimated.
5. Shaded results exceeded the quantification range and a diluted sample was analyzed.
6. Bracketed 'c' indicates compound is carcinogenic.

Table 2

SUMMARY ANALYTICAL RESULTS
VOLATILE ORGANICS AND METALS
FIRST SAMPLING EVENT SELECT SAMPLES

Boring I.D.	S-109	S-109	S-110
Sample I.D.	S-2	S-3	S-3
CompuChem I.D.	382903	382913	382920
Sample Depth (ft)	15.0-17.0	24.0-26.0	24.0-26.0
Sample Date	11/19/91	11/19/91	11/19/91
COMPOUND			
Volatiles (ug/kg)			
Methylene Chloride	21 B	22 B	15 B
Acetone	27 B	45 B	28 B
Chloroform	2 J	6 U	6 U
2-Butanone	12 U	3 J	11 U
Benzene	6 U	14	16
Tetrachloroethene	6 U	3 J	6 U
Toluene	3 J	9	5 J
Metals (mg/kg)			
Aluminum	1080	1340	1680
Antimony	6.40 U	6.10 U	6.70 U
Arsenic	7.00	15.6	34.2
Barium	3.90 B	5.00 B	6.50 B
Beryllium	0.21 U	0.20 U	0.37 B
Cadmium	0.64 U	0.61 U	0.67 U
Calcium	73300	73100	75500
Chromium	3.40	3.10	4.10
Cobalt	2.00 B	2.60 B	3.00 B
Copper	281	626	1370
Iron	3780	4000	5200
Lead	2.90	4.50	10.4
Magnesium	37100	35200	35300
Manganese	185	177	210
Mercury	0.09 U	0.10 U	0.10 U
Nickel	2.10 B	2.60 B	3.90 B
Potassium	146 B	166 B	225 B
Selenium	1.40	0.66 B	0.90 B
Silver	1.10 U	1.00 U	1.10 U
Sodium	131 B	149 B	187 B
Thallium	0.42 U	0.44 U	0.44 U
Vanadium	8.80 B	6.50 B	6.00 B
Zinc	49.2	266	428

NOTES:
1. Volatile compounds not listed were not detected in any sample.
2. Qualifier 'U' indicates not detected at given quantification limit.
3. Qualifier 'J' indicates detected below quantification limit and estimated.
4. Qualifier 'B' indicates compound detected in associated laboratory blank.

Table 3

DESIGNATED SOILS VOLUMES CONTAINED BY AREA

EXCAVATION AREA	DATE CONTAINED	VOLUME (CU. YD)
Area C Trench	12/11/90	230
Area A Trench	12/11/90	130
Area 1	2/14/91 - 2/15/91	133
Area 2	2/15/91	120
Area 3	2/15/91	183
Area N	3/19/91 - 3/20/91	220
Area A (west)	3/19/91	250
Area A (east)	3/30/91 - 4/2/91	1,350
TOTAL VOLUME		**2,616**

Table 4

SUMMARY ANALYTICAL RESULTS
STOCKPILE UNDERDRAIN TREATMENT EFFLUENT

Sample I.D.		MH032091	PNEF-E	PNEF-E2	PNEF-E3	PNEF-E4
Kemron I.D.		4105323	06-105-01	06-134-01	06-173-01	06-222-01
Sample Date		3/20/91	6/6/91	6/10/91	6/12/91	6/15/91
COMPOUND						
Volatiles	(ug/L)					
Methylene Chloride		22	5 U	5 U	5 U	5 U
2-Butanone		10 U	10 U	10 U	10 U	10 U
Benzene		5 U	5 U	71	5 U	5 U
Toluene		180	5 U	52	5 U	5 U
Ethylbenzene		5 U	2 J	5 U	5 U	5 U
Styrene		5 U	5 U	2 J	5 U	5 U
Total Xylenes		5 U	5 U	7	5 U	5 U
Semivolatiles	(ug/L)					
Phenol		10 U	10 U	10 U	10 U	32
Acenaphthene		57	10 U	10 U	10 U	10 U
Dibenzofuran		22	10 U	10 U	10 U	10 U
Fluorene		29	10 U	10 U	10 U	10 U
Bis (2-Ethylhexyl) Phthalate		14	10 U	10 U	10 U	10 U
PCBs	(ug/L)					
Aroclor 1016		NT	NT	NT	0.50 U	0.50 U
Aroclor 1221		NT	NT	NT	0.50 U	0.50 U
Aroclor 1232		NT	NT	NT	0.50 U	0.50 U
Aroclor 1242		NT	NT	NT	0.50 U	0.50 U
Aroclor 1248		NT	NT	NT	0.50 U	0.50 U
Aroclor 1254		NT	NT	NT	1.0 U	1.0 U
Aroclor 1260		NT	NT	NT	1.0 U	1.0 U
Oil and Grease	(mg/L)	NT	< 1	< 1	< 1	< 1
Suspended Solids	(mg/L)	NT	< 5	< 5	13	< 5

NOTES:
1. Volatile and semivolatile compounds not listed were not detected in any sample.
2. Qualifier 'U' indicates not detected at given quantification limit.
3. Qualifier 'J' indicates detected below quantification limit and estimated.
4. NT indicates no test performed on sample.

Table 5

TRANSFER SUMMARY
STOCKPILE UNDERDRAIN WATER

Transfer to OMC Tank Farm

Date	Tanker Loads	Load Volume (gal)	Total Volume (gal)
4/12/91	7	5,000	35,000
4/17/91	3	5,500	16,500
TOTAL	10		**51,500**

Tank Farm Storage Summary

Storage Period	OMC Tank No.	Stored Volume (gal)
4/12/91 - 6/14/91	21	14,000
4/12/91 - 6/14/91	22	7,000
4/12/91 - 6/14/91	23	14,000
4/12/91 - 6/14/91	32	16,500
TOTAL		**51,500**

Transfer from OMC Tank Farm

Date	Tanker Loads	Load Volume (gal)	Total Volume (gal)
6/10/91	3	5,500	16,500
6/11/91	2	5,500	11,000
6/12/91	2	5,500	11,000
6/13/91	2	5,500	11,000
6/14/91	1	2,000	2,000
TOTAL	10		**51,500**

NOTES:

1. All loads were handled by a licensed special waste hauler.
2. All loads were manifested as a special waste/non-hazardous waste.
3. Tank farm was inspected daily for any evidence of leaks.

Table 6

TREATMENT SUMMARY
STOCKPILE UNDERDRAIN WATER

DATE	DAILY VOLUME (gallons)	CUMULATIVE VOLUME (gallons)	SAMPLE TAKEN
6/5/91	11,500	11,500	No
6/6/91	12,000	23,500	Yes
6/7/91	7,000	30,500	No
6/8/91	0	30,500	No
6/9/91	0	30,500	No
6/10/91	14,000	44,500	Yes
6/11/91	12,500	57,000	No
6/12/91	10,080	67,080	Yes
6/13/91	10,800	77,880	No
6/14/91	11,000	88,880	No
6/15/91	9,500	98,380	Yes
TOTAL	**98,380**	**98,380**	**4**

NOTES:

1. Treatment consisted of pumping water through two carbon units aligned in series.
2. Water was discharged into closed New Slip basin.
3. All samples were analyzed for VOCs, SVOCs, oil and grease, and suspended solids.
4. The third and fourth samples were also analyzed for polychlorinated biphenyls.

Table 7

SUMMARY SEMIVOLATILE ORGANICS RESULTS
NEW SLIP AND UPPER HARBOR WATER AND SEDIMENT

SAMPLE INFORMATION

Sample I.D.	NS04-O	NS04-O	NS05-O	NS05-O	UH01-O	UH02-O	NS02-O	NS02-O	OF
Sample Name	NewSlip-1	NewSlip-1DL	NewSlip-2	NewSlip-2DL	Harbor-1	Harbor-2	Scum	Scum DL	Fieldblank
Sample Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water
Kemron I.D.	04-145-05	04-145-05	04-145-02	04-145-02	04-145-01	04-145-06	04-145-03	04-145-03	04-146-04
Sample Depth (ft)	3.0	3.0	3.0	3.0	15.0	15.0	0.0	0.0	NA
Sample Date	4/8/91	4/8/91	4/8/91	4/8/91	4/8/91	4/8/91	4/8/91	4/8/91	4/8/91

COMPOUNDS

Phenol	4000	9700	5500	13000			3400	7500	
2-Methylphenol	1400	1500	2100	2000			1200	1100	
4-Methylphenol	2700	4100	4700	5300			2600	3200	
2,4-Dimethylphenol	210		240	250			170		
Benzoic Acid									
Naphthalene	16		10				9		
2-Methylnaphthalene	21		12				10		
Acenaphthylene	5		5				12		
Acenaphthene	54		60				66		
Dibenzofuran	32		33				45		
Fluorene	44		47				98		
Phenanathrene	53		53				480	570	
Anthracene	5		5				75		
Fluoranthene	18		21				450	430	
Pyrene	10		13				310	290	
Benzo (a) Anthracene [c]							95		
Chrysene [c]							120		
bis (2-Ethylhexyl) Phthalate									
Benzo (b) Fluoranthene [c]							68		
Benzo (k) Fluoranthene [c]							49		
Benzo (a) Pyrene [c]							55		
Indeno (1,2,3-cd) Pyrene [c]							25		
Dibenzo (a,h) Anthracene [c]							8		
Benzo (g,h,i) Perylene							22		

Total Phenols	8310	15300	12540	20550	0	0	7370	11800	0
Total Carc. PNAs	0	0	0	0	0	0	420	0	0
Total Non-Carc. PNAs	258	0	259	0	0	0	1577	1290	0
Total PNAs	258	0	259	0	0	0	1997	1290	0

Table 7

SUMMARY SEMIVOLATILE ORGANICS RESULTS
NEW SLIP AND UPPER HARBOR WATER AND SEDIMENT
(continued)

SAMPLE INFORMATION

Sample I.D.	NS04-O	NS04-O	NS05-O	NS05-O	OF	UH03-O	UH03-O	UH04-O	UH05-O
Sample Name	NewSlip-1A	NewSlip-1ADL	NewSlip-2A	NewSlip-2ADL	Rinseblank	Sediment-1	Sediment-1DL	Sediment-2	Sediment-3
Sample Matrix	Water	Water	Water	Water	Water	Soil	Soil	Soil	Soil
Kemron I.D.	04-298-01	04-298-01	04-298-05	04-298-05	04-298-04	04-371-03	04-371-03	04-371-04	04-371-07
Sample Depth (ft)	3.0	3.0	3.0	3.0	NA	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0
Sample Date	4/19/91	4/19/91	4/19/91	4/19/91	4/19/91	4/25/91	4/25/91	4/25/91	4/25/91

COMPOUNDS

Phenol	450	570	430	460		3100	3100		
2-Methylphenol	330	420	350	360		1000	950		
4-Methylphenol	480	610	490	530		9900	10000	73	
2,4-Dimethylphenol	59	62	60	58		1800	1500		110
Benzoic Acid	5					160			
Naphthalene	3					4700	5000	750	130
2-Methylnaphthalene						360		370	100
Acenaphthylene						91		240	
Acenaphthene	4		4			1400	1300	2100	
Dibenzofuran						820	710	1500	49
Fluorene						1700	1500	2600	82
Phenanathrene						3100	3100	5900	240
Anthracene						1100	920	2400	110
Fluoranthene	14		14			2100	2100	4300	260
Pyrene	10		10			1500	1400	3000	210
Benzo (a) Anthracene [c]						580	570	1300	110
Chrysene [c]						660	640	2100	180
bis (2-Ethylhexyl) Phthalate	5		5		4	160		57	180
Benzo (b) Fluoranthene [c]						330		690	99
Benzo (k) Fluoranthene [c]						290		540	82
Benzo (a) Pyrene [c]						280		680	83
Indeno (1,2,3-cd) Pyrene [c]						160		420	
Dibenzo (a,h) Anthracene [c]								100	
Benzo (g,h,i) Perylene						150		360	54
Total Phenols	1319	1662	1330	1408	0	15800	15550	73	110
Total Carc. PNAs	0	0	0	0	0	2300	1210	5830	554
Total Non-Carc. PNAs	41	0	33	0	4	17341	16030	23577	1415
Total PNAs	41	0	33	0	4	19641	17240	29407	1969

Table 7

SUMMARY SEMIVOLATILE ORGANICS RESULTS
NEW SLIP AND UPPER HARBOR WATER AND SEDIMENT
(continued)

SAMPLE INFORMATION

Sample I.D.	NS01-O	NS01-OD	NS02-O	NS03-O	NS04-O	OF	NS04-O	NS04	
Sample Name	NS01	NS01	NS02	NS03	NS04	Blank	NS04	NS04	
Sample Matrix	Soil	Soil	Soil	Soil	Water	Water	Soil	Water	
Kemron I.D.	05-007-01	05-007-02	05-007-03	05-007-04	05-026-01	05-026-02	05-064-01	06-220-01	
Sample Depth (ft)	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	3.0	NA	3.0	3.0	
Sample Date	4/30/91	4/30/91	4/30/91	4/30/91	4/30/91	4/30/91	5/2/91	6/17/91	

COMPOUNDS

Phenol		380			46		340		
2-Methylphenol					82		88		
4-Methylphenol			99		62		170		
2,4-Dimethylphenol					30		78		
Benzoic Acid									
Naphthalene			75	70			1500		
2-Methylnaphthalene			44				630		
Acenaphthylene							160		
Acenaphthene	55	89	57	56			1100		
Dibenzofuran			52	47			950		
Fluorene				82			1700		
Phenanathrene	63	41	180	280			5600		
Anthracene			53	86			1800		
Fluoranthene	140	110	220	330	3		3900		
Pyrene	100	83	170	220	4		2500		
Benzo (a) Anthracene [c]	49	44	100	93			940		
Chrysene [c]	78	59	130	100			1200		
bis (2-Ethylhexyl) Phthalate					3		190	13	
Benzo (b) Fluoranthene [c]	56		83				610		
Benzo (k) Fluoranthene [c]	44		74	52			470		
Benzo (a) Pyrene [c]			62				480		
Indeno (1,2,3-cd) Pyrene [c]							240		
Dibenzo (a,h) Anthracene [c]									
Benzo (g,h,i) Perylene							190		
Total Phenols	0	380	99	0	220	0	676	0	
Total Carc. PNAs	227	103	449	245	0	0	3940	0	
Total Non-Carc. PNAs	358	323	851	1171	10	0	20220	13	
Total PNAs	585	426	1300	1416	10	0	24160	13	

Table 7

SUMMARY SEMIVOLATILE ORGANICS RESULTS
NEW SLIP AND UPPER HARBOR WATER AND SEDIMENT
(continued)

NOTES:

1. All results presented in micrograms per kilogram or micrograms per liter (parts per billion).
2. Semivolatile compounds not listed were not detected in any sample.
3. Results presented in boldface were detected above the quantification limit.
4. Results presented in normal typeface were detected below the quantification limit and estimated.
5. Shaded results exceeded the quantification range and a diluted sample was analyzed.
6. NA indicates not applicable.
7. Bracketed 'c' indicates compound is carcinogenic.

Table 8

SUMMARY VOLATILE ORGANIC RESULTS
NEW SLIP AND UPPER HARBOR WATER AND SEDIMENT

SAMPLE INFORMATION									
Sample I.D.	NS04-O	NS05-O	UH01-O	UH02-O	NS02-O	OF	UH03-O	UH04-O	UH05-O
Sample Name	NewSlip-1	NewSlip-2	Harbor-1	Harbor-2	Scum	Fieldblank	Sediment-1	Sediment-2	Sediment-3
Sample Matrix	Water	Water	Water	Water	Water	Water	Soil	Soil	Soil
Kemron I.D.	04-146-05	04-146-02	04-146-01	04-146-06	04-146-03	04-146-03	04-371-03	04-371-04	04-371-07
Sample Depth (ft)	3.0	3.0	15.0	15.0	0.0	NA	0.0-1.0	0.0-1.0	0.0-1.0
Sample Date	4/8/91	4/8/91	4/8/91	4/8/91	4/8/91	4/8/91	4/25/91	4/25/91	4/25/91
COMPOUNDS									
Methylene Chloride	9 B	10 B	13 B	10 B	10 B	8 B	110	170 B	140 B
Acetone	19	22	10 U	10 U	10 U	10 U	190	12 U	13 U
Carbon Disulfide	5 U	5 U	5 U	5 U	7	5 U	7 U	6 U	7 U
2-Butanone	10 U	10 U	10 U	10 U	10 U	10 U	13 U	29	13 U
Benzene	8	9	14	16	10	5 U	37	6 U	7 U
Toluene	2 BJ	11 B	11 B	12 B	3 BJ	2 BJ	22	6 U	15
Ethylbenzene	1 J	2 J	5 U	5 U	5 U	5 U	44	6 U	7 U
Total Xylenes	4 J	5	29	36	3 J	1 J	130	6 U	7 U

SAMPLE INFORMATION								
Sample I.D.	NS04-O	NS01-O	NS01-OD	NS02-O	NS03-O	OF	NS04-O	NS04
Sample Name	NS04	NS01	NS01	NS02	NS03	Blank	NS04	NS04
Sample Matrix	Water	Soil	Soil	Soil	Soil	Water	Soil	Water
Kemron I.D.	05-026-01	05-007-01	05-007-02	05-007-03	05-007-04	05-026-02	05-064-01	06-220-01
Sample Depth (ft)	3.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	NA	0.0-1.0	3.0
Sample Date	4/30/91	4/30/91	4/30/91	4/30/91	4/30/91	4/30/91	5/2/91	6/17/91
COMPOUNDS								
Methylene Chloride	6 B	88	17	16	220	4 J	180	5 U
Acetone	25	42	84	57	120	15	26 B	10 U
Carbon Disulfide	5 U	6 U	6 U	6 U	6 U	5 U	7 U	5 U
2-Butanone	7 J	32	12 U	11 U	12 U	10 U	5 J	28
Benzene	5 U	6 U	6 U	6 U	6 U	2 J	7 U	5 U
Toluene	2 J	7	4 J	6 U	6 U	42	7 U	1 J
Ethylbenzene	5 U	6 U	6 U	6 U	6 U	5 U	3 J	5 U
Total Xylenes	5 U	6 U	6 U	6 U	6 U	5 U	3 J	5 U

NOTES:

1. All results presented in micrograms per kilogram or microgram per liter (parts per billion).
2. Volatile compounds not listed were not detected in any sample.
3. Qualifier 'U' indicates not detected at given quantification limit.
4. Qualifier 'J' indicates detected below quantification limit and estimated.
5. Qualifier 'B' indicates compound was also detected in associated laboratory blank
6. NA indicates not applicable.

Table 9

SUMMARY ANALYTICAL RESULTS
METALS AND CYANIDE
NEW SLIP AND UPPER HARBOR WATER AND SEDIMENT

SAMPLE INFORMATION

Sample I.D.		NS04-O	NS05-O	UH01-O	UH02-O	NS02-O	OF	NS04-O
Sample Name		NewSlip-1	NewSlip-2	Harbor-1	Harbor-2	Scum	Fieldblank	NewSlip-1A
Sample Matrix		Water	Water	Water	Water	Water	Water	Water
Kemron I.D.		04-145-05	04-145-02	04-145-01	04-145-06	04-145-03	04-145-04	04-298-01
Sample Depth (ft)		3.0	3.0	15.0	15.0	0.0	NA	3.0
Sample Date		4/8/91	4/8/91	4/8/91	4/8/91	4/8/91	4/8/91	4/19/91
METAL	(mg/L or mg/kg)							
Antimony		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	NT
Arsenic		0.7	0.6	0.006	0.005	0.6	<0.004	0.22
Beryllium		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NT
Cadmium		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NT
Chromium		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	NT
Copper		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	NT
Iron		1.2	1.3	0.52	0.21	1.3	<0.04	NT
Lead		<0.005	<0.005	0.005	<0.005	<0.005	<0.005	NT
Mercury		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	NT
Nickel		<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	NT
Selenium		0.01	0.01	<0.004	<0.004	0.01	<0.004	NT
Silver		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NT
Thallium		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NT
Zinc		0.07	0.05	0.02	0.02	0.06	0.02	NT
Cyanide	(mg/L or mg/kg)	NT	NT	NT	NT	NT	NT	NT

NOTES:
1. NT indicates no test was run.
2. NA indicates not applicable.

Table 9

SUMMARY ANALYTICAL RESULTS
METALS AND CYANIDE
NEW SLIP AND UPPER HARBOR WATER AND SEDIMENT
(continued)

SAMPLE INFORMATION

Sample I.D.		NS05-O	OF	NS04-O	UH01-O	UH03-O	UH04-O	UH05-O
Sample Name		NewSlip-2A	Rinseblank	NewSlip-1B	Harbor-1B	Sediment-1	Sediment-2	Sediment-3
Sample Matrix		Water	Water	Water	Water	Soil	Soil	Soil
Kemron I.D.		04-298-05	04-298-04	04-371-01	04-371-02	04-371-03	04-371-04	04-371-07
Sample Depth (ft)		3.0	NA	3.0	15.0	0.0-1.0	0.0-1.0	0.0-1.0
Sample Date		4/19/91	4/19/91	4/25/91	4/25/91	4/25/91	4/25/91	4/25/91
METAL	(mg/L or mg/kg)							
Antimony		NT	NT	NT	NT	<10	<10	<10
Arsenic		0.21	<0.004	NT	NT	13	1.8	1.9
Beryllium		NT	NT	NT	NT	<0.5	<0.5	<0.5
Cadmium		NT	NT	NT	NT	<0.5	<0.5	<0.5
Chromium		NT	NT	NT	NT	5	2	4
Copper		NT	NT	NT	NT	14	<2	8
Iron		NT	NT	NT	NT	3900	2400	2400
Lead		NT	NT	NT	NT	20	<10	<10
Mercury		NT	NT	NT	NT	<0.25	0.3	<0.25
Nickel		NT	NT	NT	NT	2	<2	4
Selenium		NT	NT	NT	NT	0.3	<0.2	0.9
Silver		NT	NT	NT	NT	<2	<2	<2
Thallium		NT	NT	NT	NT	<0.25	<0.25	<0.25
Zinc		NT	NT	NT	NT	34	13	7.4
Cyanide	(mg/L or mg/kg)	NT	NT	0.02	<0.01	NT	NT	NT

NOTES:
1. NT indicates no test was run.
2. NA indicates not applicable.

Table 9

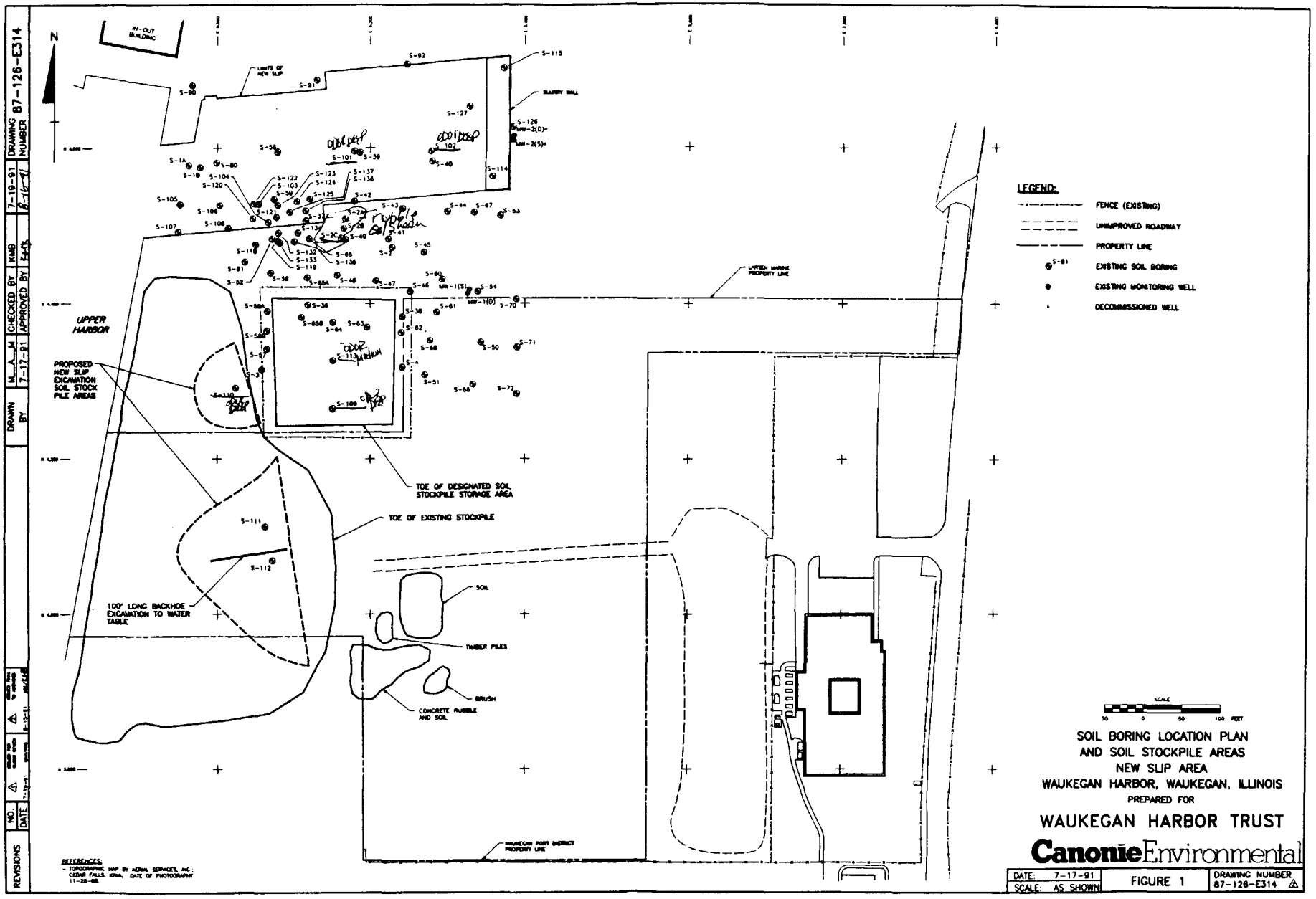
SUMMARY ANALYTICAL RESULTS
METALS AND CYANIDE
NEW SLIP AND UPPER HARBOR WATER AND SEDIMENT
(continued)

SAMPLE INFORMATION

Sample I.D.		NS04-O	NS01-O	NS01-OD	NS02-O	NS03-O	OF	NS04-O
Sample Name		NS04	NS01	NS01	NS02	NS03	Blank	NS04
Sample Matrix		Water	Soil	Soil	Soil	Soil	Water	Soil
Kemron I.D.		05-026-01	05-007-01	05-007-02	05-007-03	05-007-04	05-026-02	05-064-01
Sample Depth (ft)		3.0	0.0-1.0	0.0-1.0	0.0-1.0	0.0-1.0	NA	0.0-1.0
Sample Date		4/30/91	4/30/91	4/30/91	4/30/91	4/30/91	4/30/91	5/2/91
METAL	(mg/L or mg/kg)							
Antimony		<0.25	<10	<10	<10	<10	<0.25	<10
Arsenic		0.32	3.5	3.1	2.3	3.5	<0.004	15
Beryllium		<0.01	<0.5	<0.5	<0.5	<0.5	<0.01	<0.5
Cadmium		<0.01	<0.5	<0.5	<0.5	<0.5	<0.01	<0.5
Chromium		<0.02	5	4	3	2	<0.02	4
Copper		<0.02	2	3	<2	<2	<0.02	2
Iron		0.61	3500	3300	2800	1700	0.18	3600
Lead		<0.005	2.5	2.0	1.4	0.9	0.007	<10
Mercury		<0.0002	<0.1	<0.1	<0.1	<0.1	<0.0002	<0.25
Nickel		<0.04	3	2	2	<2	<0.04	3
Selenium		0.008	<0.2	<0.2	0.2	0.4	<0.004	0.2
Silver		<0.01	<2	<2	<2	<2	<0.01	<2
Thallium		<0.005	<0.25	<0.25	<0.25	<0.25	<0.005	<0.25
Zinc		0.07	18	14	13	9.4	0.04	22
Cyanide	(mg/L or mg/kg)	0.02	<0.5	<0.5	<0.5	<0.5	<0.01	<0.5

NOTES:
1. NT indicates no test was run.
2. NA indicates not applicable.

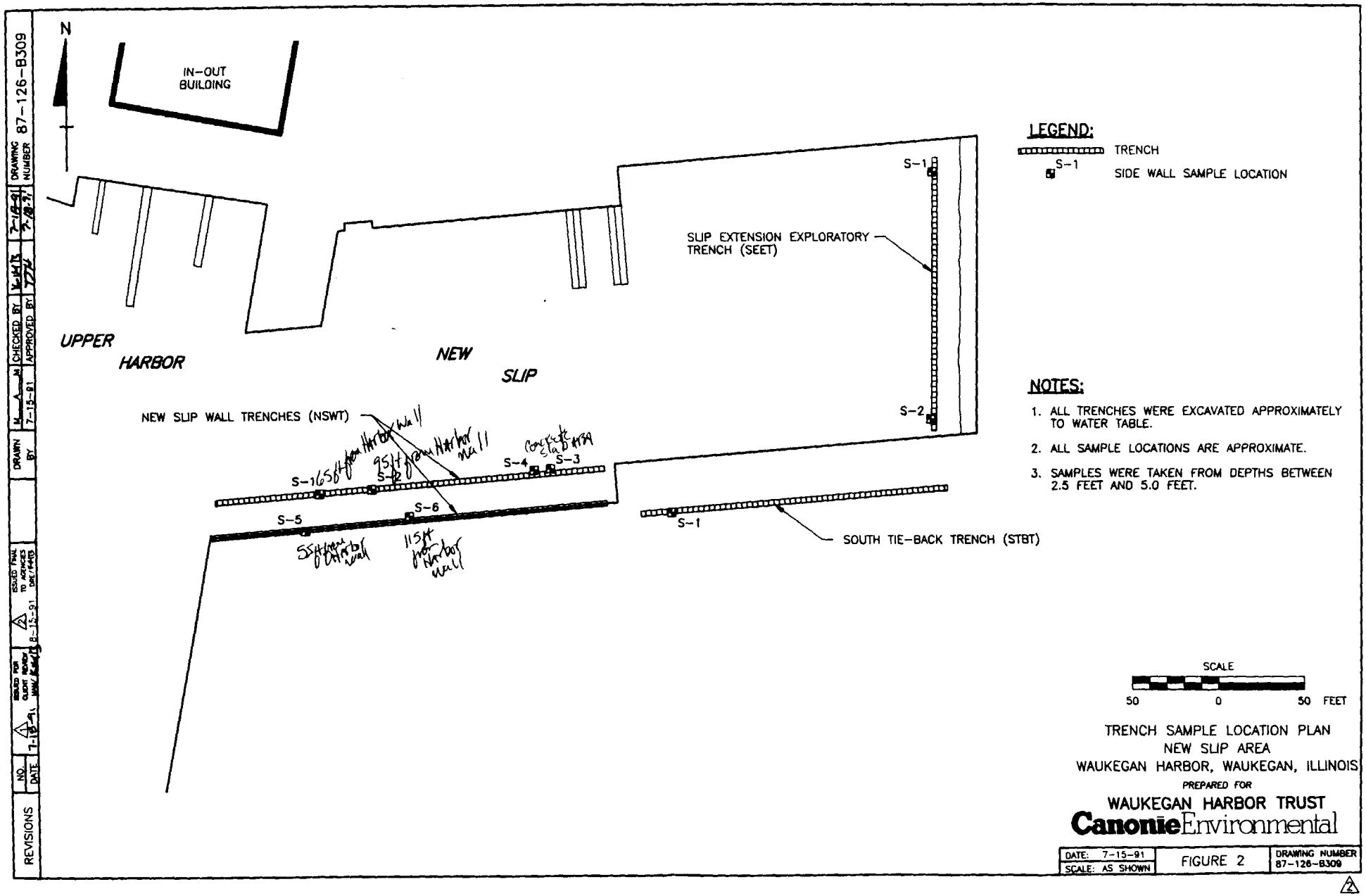
FIGURES

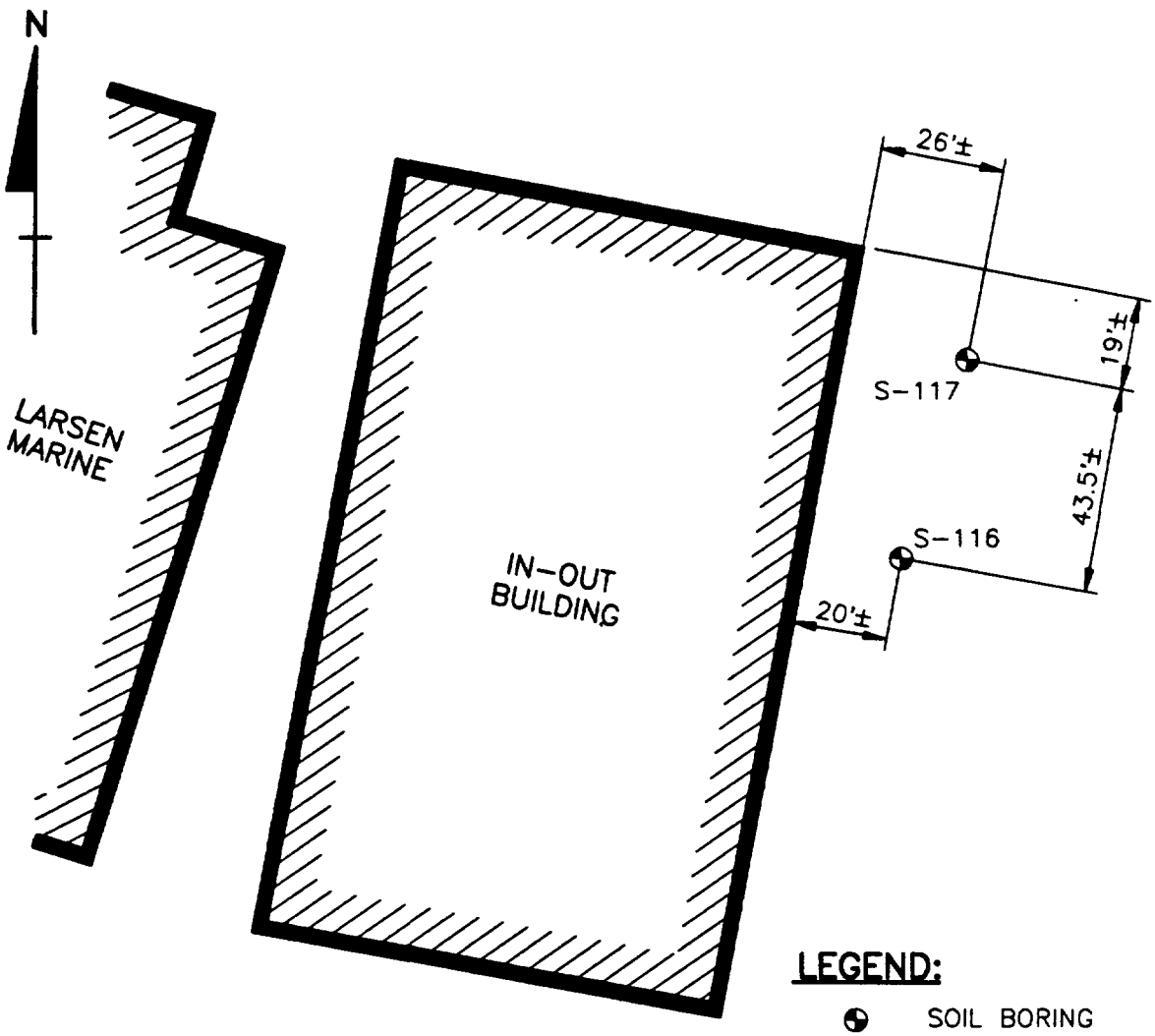


SOIL BORING LOCATION PLAN
AND SOIL STOCKPILE AREAS
NEW SLIP AREA
WAUKEGAN HARBOR, WAUKEGAN, ILLINOIS
PREPARED FOR
WAUKEGAN HARBOR TRUST

Canonie Environmental

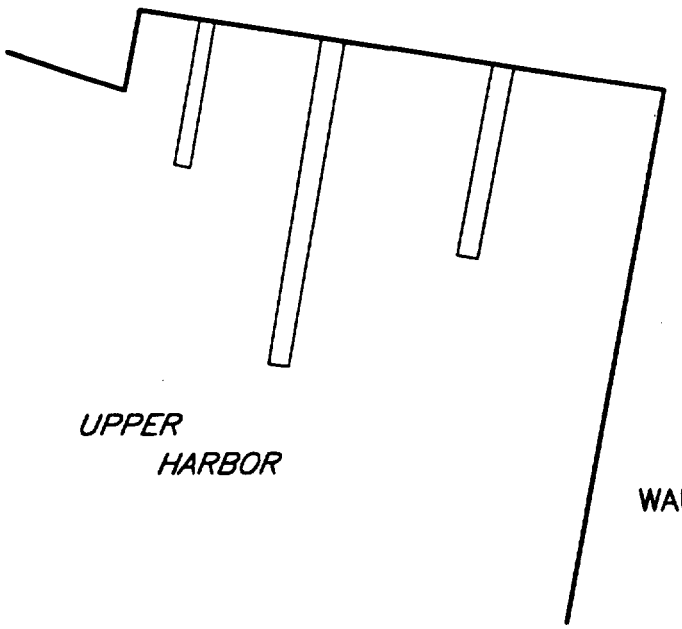
DATE: 7-17-91	FIGURE 1	DRAWING NUMBER 87-126-E314 Δ
SCALE: AS SHOWN		


N
IN-OUT BUILDING
UPPER HARBOR
NEW SLIP
SLIP EXTENSION EXPLORATORY TRENCH (SEET)
NEW SLIP WALL TRENCHES (NSWT)
SOUTH TIE-BACK TRENCH (STBT)
S-1
S-2
S-3
S-4
S-5
S-6
LEGEND:
TRENCH
SIDE WALL SAMPLE LOCATION
NOTES:
1. ALL TRENCHES WERE EXCAVATED APPROXIMATELY TO WATER TABLE.
2. ALL SAMPLE LOCATIONS ARE APPROXIMATE.
3. SAMPLES WERE TAKEN FROM DEPTHS BETWEEN 2.5 FEET AND 5.0 FEET.
SCALE
50 0 50 FEET
TRENCH SAMPLE LOCATION PLAN
NEW SLIP AREA
WAUKEGAN HARBOR, WAUKEGAN, ILLINOIS
PREPARED FOR
WAUKEGAN HARBOR TRUST
CanonieEnvironmental
DATE: 7-15-91
SCALE: AS SHOWN
FIGURE 2
DRAWING NUMBER 87-126-B309
REVISIONS
NO.
DATE
ISSUED FOR CLIENT REVIEW
ISSUED FINAL TO AGENCIES
DRAWN BY
CHECKED BY
APPROVED BY
DRAWING NUMBER 87-126-B309



LEGEND:

● SOIL BORING



NOTES:

1. SOIL BORING LOCATIONS ARE APPROXIMATE.

SCALE

40 0 40 FEET

SOIL BORING LOCATION PLAN
LARSEN MARINE PROPERTY
WAUKEGAN HARBOR, WAUKEGAN, ILLINOIS

PREPARED FOR

WAUKEGAN HARBOR TRUST

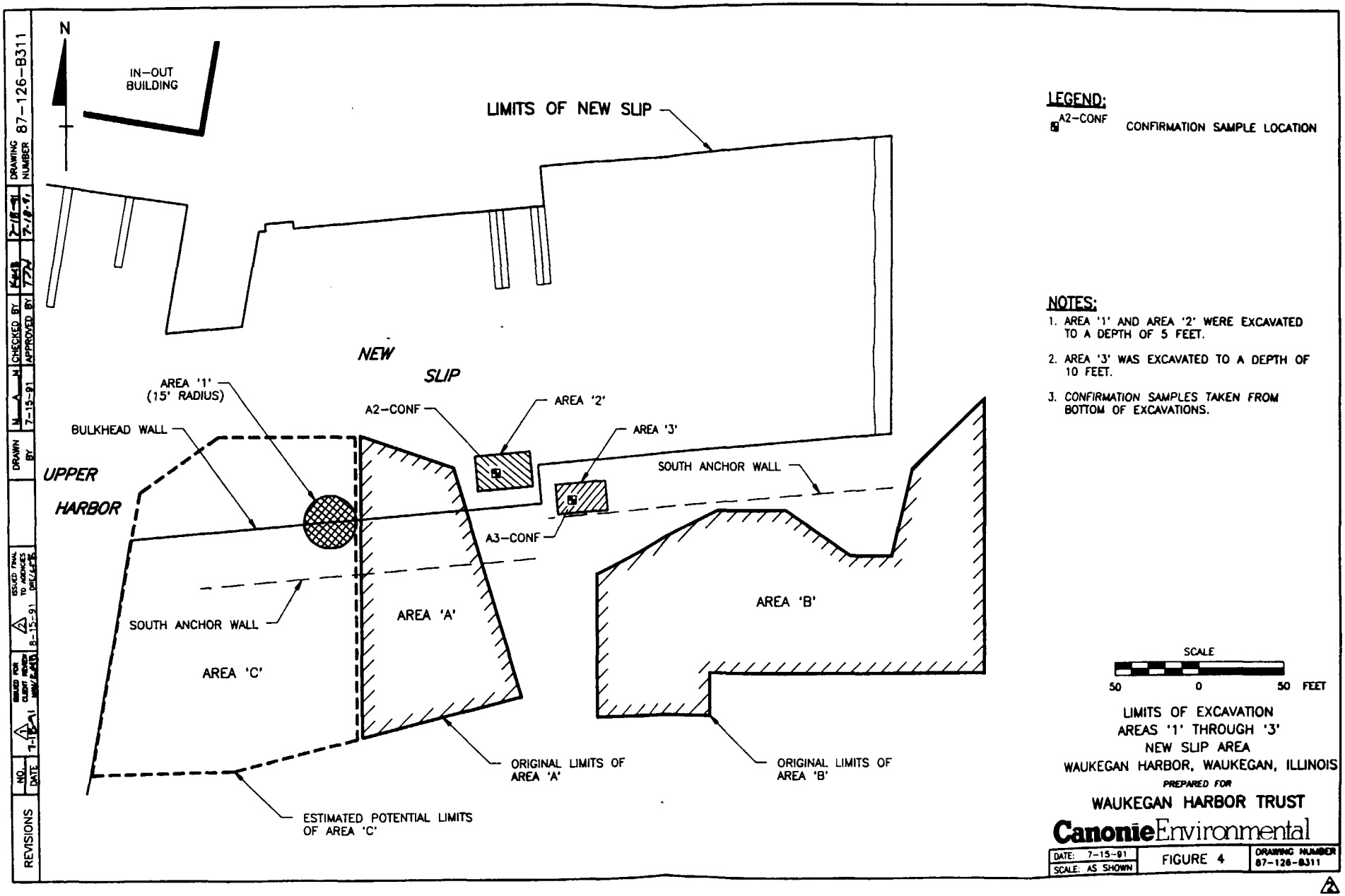
Canonie Environmental

DATE: 7-15-91	FIGURE 3	DRAWING NUMBER 87-126-A310
SCALE: AS SHOWN		

REVISIONS	NO.	DATE	DESCRIPTION	BY
	1	7-18-91	ISSUED FOR CLIENT REVIEW	MAM/KMB
	2	8-15-91	ISSUED FINAL TO AGENCIES	DRE/KMB

DRAWN BY	M A M	CHECKED BY	APPROVED BY	DRAWING NUMBER
	7-15-91	KMB	TJH	87-126-A310
		7-18-91	7-18-91	

2



LEGEND:

A2–CONF — CONFIRMATION SAMPLE LOCATION

NOTES:

1. AREA '1' AND AREA '2' WERE EXCAVATED TO A DEPTH OF 5 FEET.
2. AREA '3' WAS EXCAVATED TO A DEPTH OF 10 FEET.
3. CONFIRMATION SAMPLES TAKEN FROM BOTTOM OF EXCAVATIONS.

SCALE

50 0 50 FEET

LIMITS OF EXCAVATION
AREAS '1' THROUGH '3'
NEW SLIP AREA
WAUKEGAN HARBOR, WAUKEGAN, ILLINOIS

PREPARED FOR

WAUKEGAN HARBOR TRUST

CanonieEnvironmental

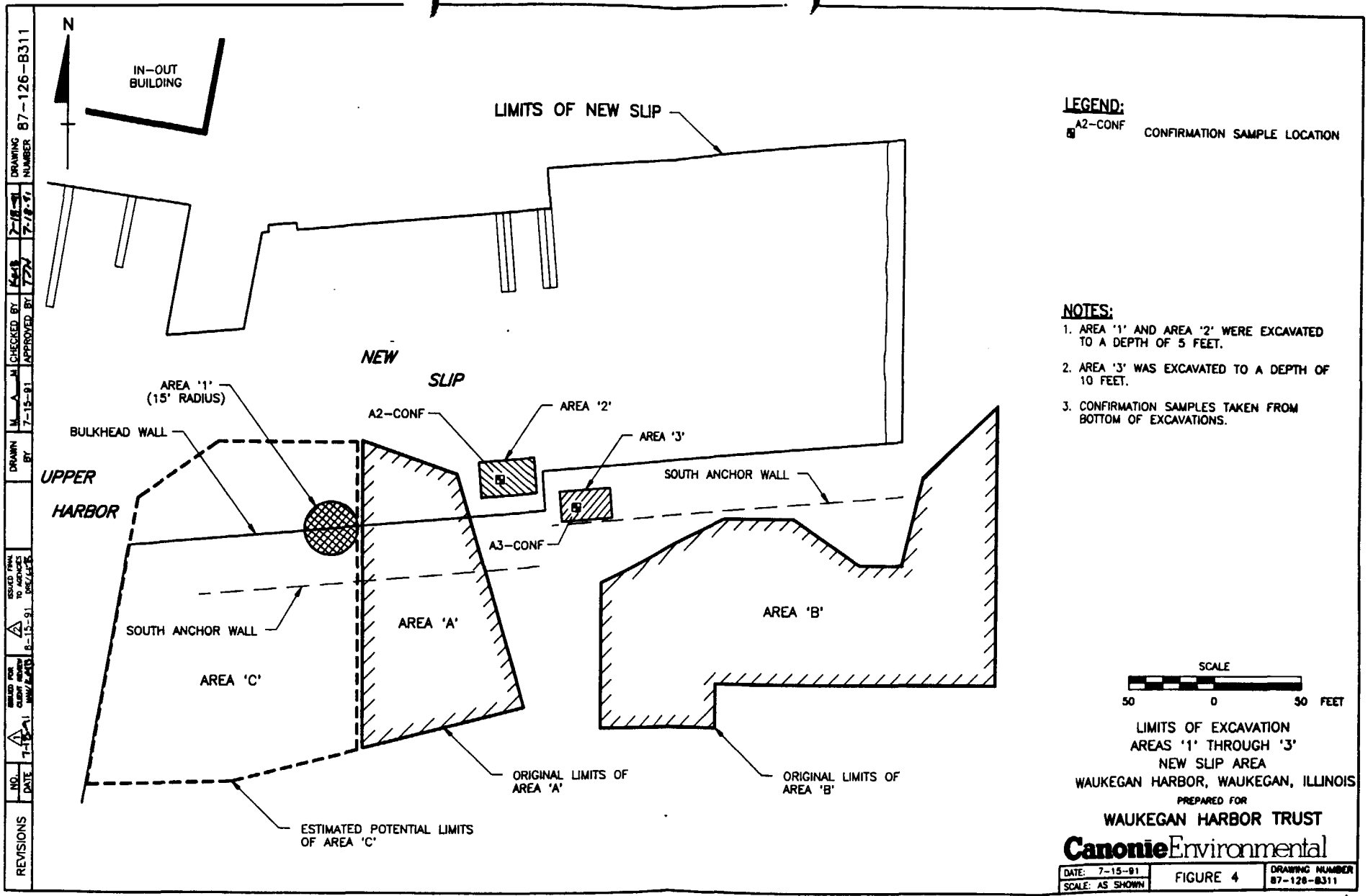
DATE: 7-15-91	FIGURE 4	DRAWING NUMBER 87-126-B311
SCALE: AS SHOWN		

REVISIONS

NO.	DATE	
1	7-15-91	ISSUED FOR CLIENT REVIEW
2	8-15-91	ISSUED FINAL TO AGENCIES

DRAWN BY: M A M 7-15-91
CHECKED BY: [illegible]
APPROVED BY: [illegible]

DRAWING NUMBER 87-126-B311



LEGEND:

A2-CONF — CONFIRMATION SAMPLE LOCATION

NOTES:

1. AREA '1' AND AREA '2' WERE EXCAVATED TO A DEPTH OF 5 FEET.
2. AREA '3' WAS EXCAVATED TO A DEPTH OF 10 FEET.
3. CONFIRMATION SAMPLES TAKEN FROM BOTTOM OF EXCAVATIONS.

SCALE

50 0 50 FEET

LIMITS OF EXCAVATION
AREAS '1' THROUGH '3'
NEW SLIP AREA
WAUKEGAN HARBOR, WAUKEGAN, ILLINOIS

PREPARED FOR

WAUKEGAN HARBOR TRUST

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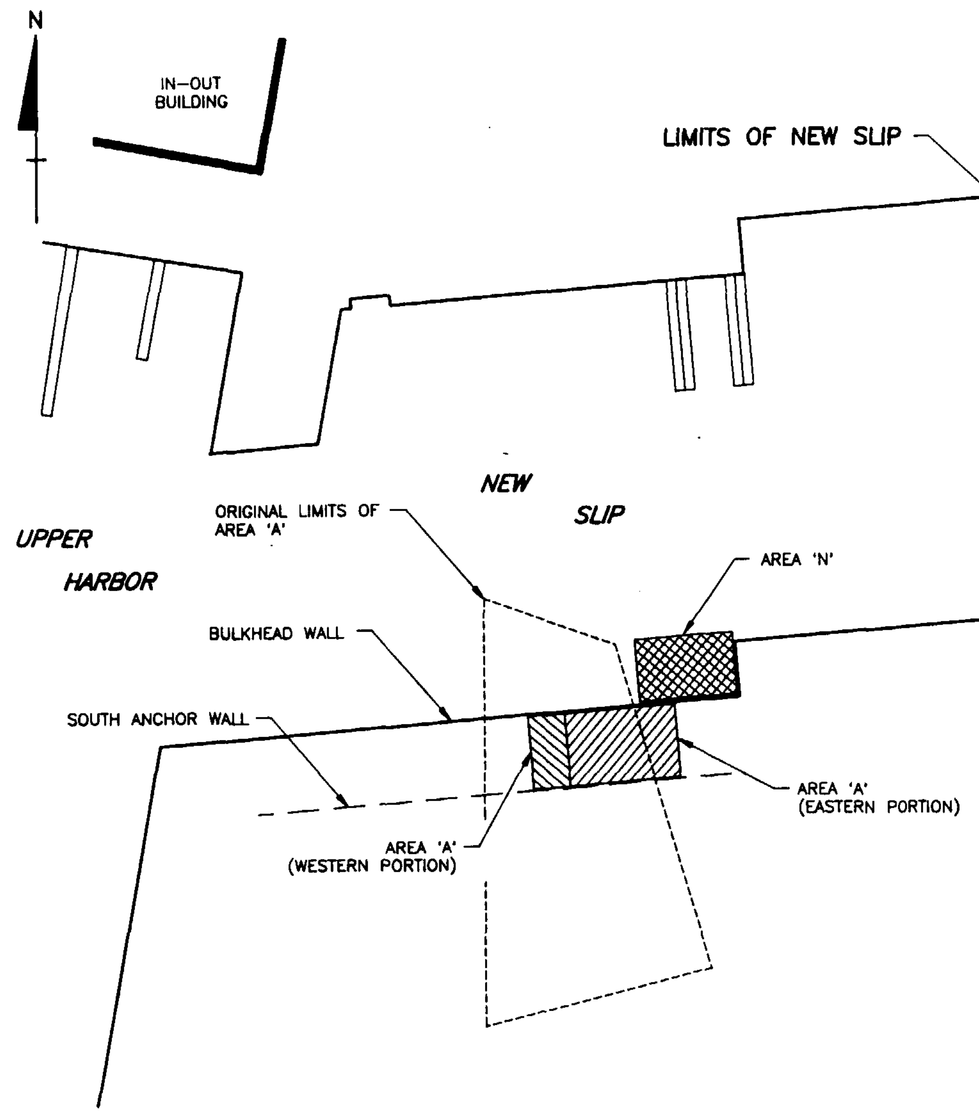
DATE: 7-15-91	FIGURE 4	DRAWING NUMBER 87-126-B311
SCALE: AS SHOWN		

REVISIONS	NO.	DATE		DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
ISSUED FINAL TO AGENCIES	3	8-15-91	M. A. M.		KAB	TJV	87-126-B311
ISSUED FOR CLIENT REVIEW	2	7-18-91	7-15-91		7-18-91	7-18-91	
	1	7-15-91					



NOTES:

1. AREA 'N' WAS EXCAVATED TO A DEPTH OF 9 FEET.
2. WESTERN PORTION OF AREA 'A' WAS EXCAVATED TO A DEPTH OF 15 FEET.
3. EASTERN PORTION OF AREA 'A' WAS EXCAVATED TO HARDPAN (APPROX. 27 FEET).
4. TEMPORARY SHEETING BETWEEN THE BULKHEAD AND ANCHOR PILE WALLS WAS USED FOR AREA 'A' EXCAVATION.

SCALE

50 0 50 FEET

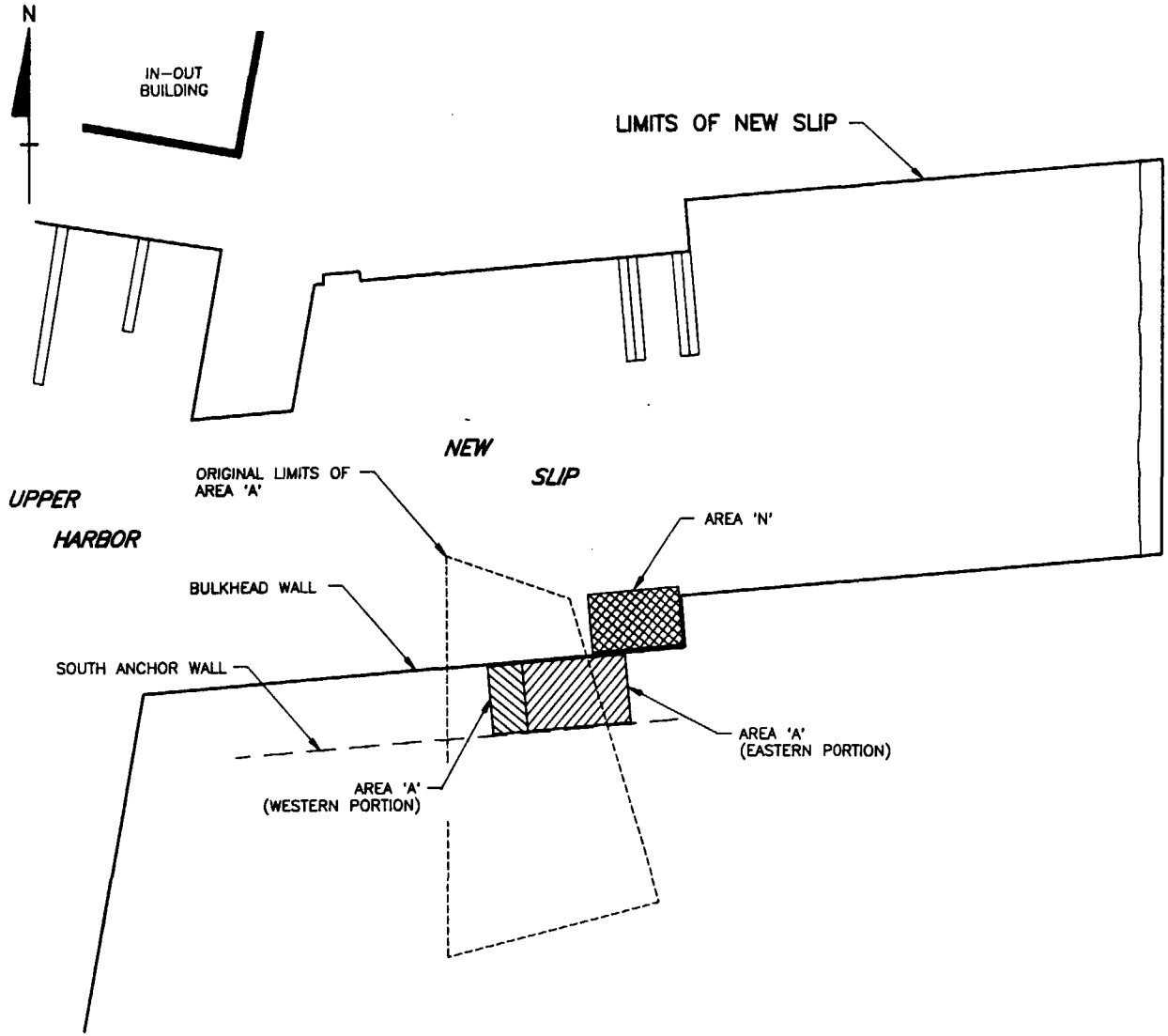
LIMITS OF EXCAVATION
AREAS 'A' AND 'N'
NEW SLIP AREA
WAUKEGAN HARBOR, WAUKEGAN, ILLINOIS

PREPARED FOR

WAUKEGAN HARBOR TRUST

CanonieEnvironmental

DATE: 7-15-91 SCALE: AS SHOWN	FIGURE 5	DRAWING NUMBER 87-126-B312



NOTES:

1. AREA 'N' WAS EXCAVATED TO A DEPTH OF 9 FEET.
2. WESTERN PORTION OF AREA 'A' WAS EXCAVATED TO A DEPTH OF 15 FEET.
3. EASTERN PORTION OF AREA 'A' WAS EXCAVATED TO HARDPAN (APPROX. 27 FEET).
4. TEMPORARY SHEETING BETWEEN THE BULKHEAD AND ANCHOR PILE WALLS WAS USED FOR AREA 'A' EXCAVATION.

SCALE

50 0 50 FEET

LIMITS OF EXCAVATION
AREAS 'A' AND 'N'
NEW SLIP AREA
WAUKEGAN HARBOR, WAUKEGAN, ILLINOIS

PREPARED FOR

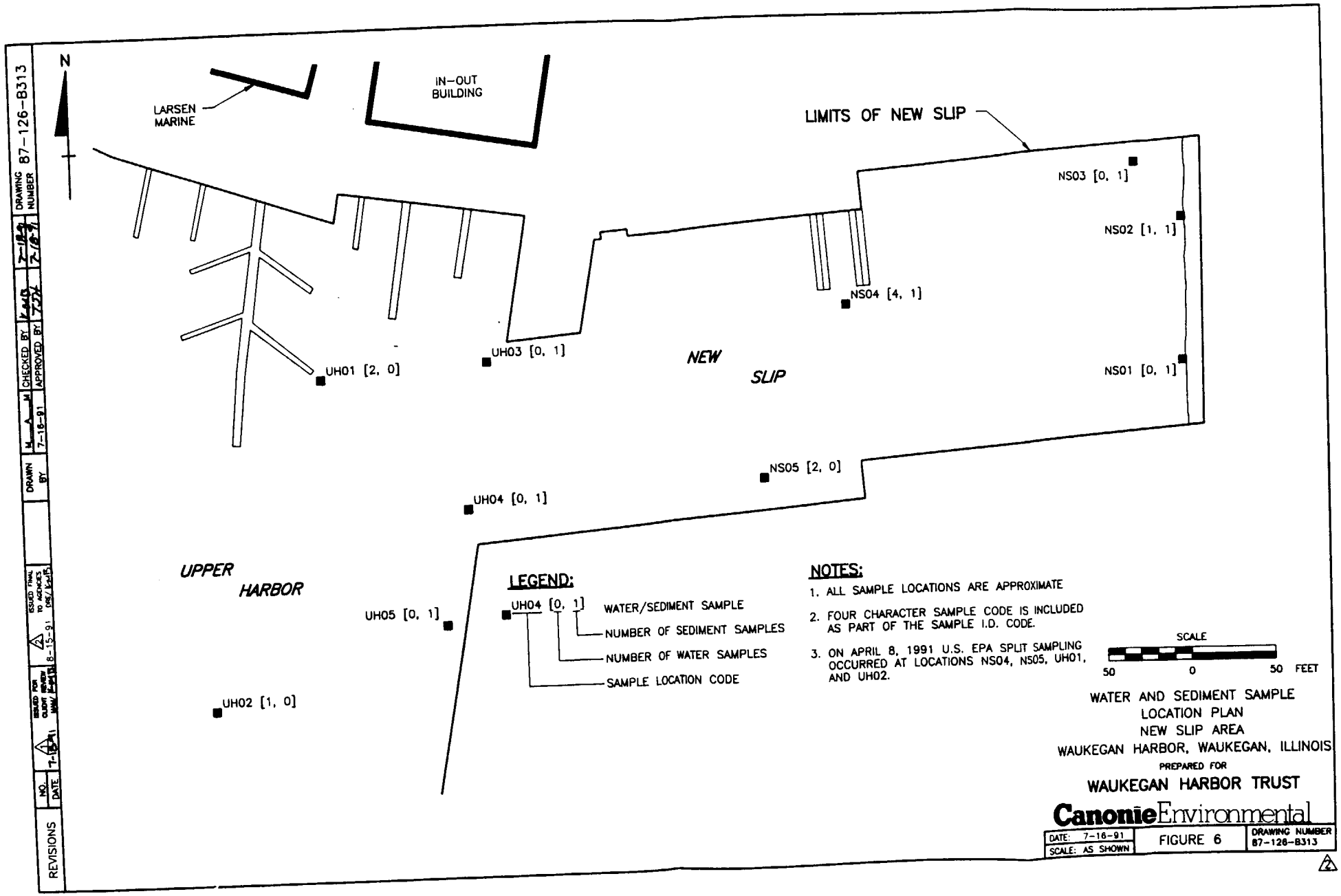
WAUKEGAN HARBOR TRUST

Canonie Environmental

DATE: 7–15–91	FIGURE 5	DRAWING NUMBER 87–126–B312
SCALE: AS SHOWN		

2

REVISIONS	NO.	DATE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
ISSUED FOR CLIENT REVIEW	1	7-15-91	M	M	TDN	87-126-B312
ISSUED FINAL TO AGENCIES	2	8-15-91				


N
LARSEN MARINE
IN-OUT BUILDING
LIMITS OF NEW SLIP
NS03 [0, 1]
NS02 [1, 1]
NS04 [4, 1]
NS01 [0, 1]
UH01 [2, 0]
UH03 [0, 1]
NEW SLIP
NS05 [2, 0]
UH04 [0, 1]
UPPER HARBOR
UH05 [0, 1]
UH02 [1, 0]
LEGEND:
UH04 [0, 1]
WATER/SEDIMENT SAMPLE
NUMBER OF SEDIMENT SAMPLES
NUMBER OF WATER SAMPLES
SAMPLE LOCATION CODE
NOTES:
1. ALL SAMPLE LOCATIONS ARE APPROXIMATE
2. FOUR CHARACTER SAMPLE CODE IS INCLUDED AS PART OF THE SAMPLE I.D. CODE.
3. ON APRIL 8, 1991 U.S. EPA SPLIT SAMPLING OCCURRED AT LOCATIONS NS04, N505, UH01, AND UH02.
SCALE
50 0 50 FEET
WATER AND SEDIMENT SAMPLE LOCATION PLAN
NEW SLIP AREA
WAUKEGAN HARBOR, WAUKEGAN, ILLINOIS
PREPARED FOR
WAUKEGAN HARBOR TRUST
CanonieEnvironmental
DATE: 7-16-91
SCALE: AS SHOWN
FIGURE 6
DRAWING NUMBER 87-126-B313
REVISIONS
NO. DATE
DRAWN BY
CHECKED BY
APPROVED BY
DRAWING NUMBER 87-126-B313

APPENDIX A

BORING LOGS

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BORING LOG

PROJECT No. 90-407
BORING No. S-101
LOGGED BY PRS
PAGE No. 1 of 1

PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4,593.9 E 5,183.1 SURFACE ELEVATION 585.0
DRILLER Fox Drilling Inc. DATE: START 11/19/90 FINISH 11/19/90

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0"	BLOW COUNT 6"	BLOW COUNT 12"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	7.0	5	8	12	18	SP				Brown Fine to Medium Sand, Wet.	
					9									
10														
15	2	SS	15.0	17.0	13	22	33	18	SP				Dark Gray Fine to Medium Sand, Wet.	
					30									
20														
												24.0		
25	3	SS	24.0	26.0	13	22	22	18	SM				Dark Gray Silty Fine Sand, Wet. Slight Odor.	
					31							26.0		
													Bottom of Boring at 26.0 Ft.	

Notes:

1. Temporary 4-inch-diameter steel wash casing was driven to a depth of 7 feet.

2. Boring was advanced using mud rotary wash with 3-7/8-inch-diameter tricone roller bit.

3. Upon completion, borehole was backfilled with cement/bentonite grout mixture.

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BORING LOG

PROJECT No. 90-407
BORING No. S-102
LOGGED BY PRS
PAGE No. 1 of 1

PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4,593.9 E 5,283.1 SURFACE ELEVATION 585.0
DRILLER Fox Drilling Inc. DATE: START 11/19/90 FINISH 11/19/90

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	7.0	3	9	13	18	SP				Brown Fine to Medium Sand, Wet.	
					16									
10														
15	2	SS	15.0	17.0	8	16	23	18	SP				Gray Fine to Medium Sand, Wet.	
					27									
20														
												24.0		
25	3	SS	24.0	26.0	19	22	29	18	SM				Dark Gray Silty Fine Sand, Wet. Odor.	
					46							26.0		
													Bottom of Boring at 26.0 Ft.	

Notes:

1. Temporary 4-inch-diameter steel wash casing was driven to a depth of 7 feet.

2. Boring was advanced using mud rotary wash with 3-7/8-inch-diameter tricone roller bit.

3. Upon completion, borehole was backfilled with cement/bentonite grout mixture.

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BORING LOG

PROJECT No. 90-407
BORING No. S-103
LOGGED BY PRS
PAGE No. 1 of 1

PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4,526.4 E 5,056.0 SURFACE ELEVATION 584.5
DRILLER Fox Drilling Inc. DATE: START 11/20/90 FINISH 11/20/90

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" to 6"	BLOW COUNT 6" to 12"	BLOW COUNT 12" to 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	7.0	6	10	13	18	SP				Brown to Gray Fine to Medium Sand, Wet.	
					15							7.0		
	2	SS	7.0	9.0	6	9	14	24	SP				Dark Gray Fine to Medium Sand, Wet.	
					28									
10	3	SS	9.0	11.0	6	14	30	24	SP				Odor. Borehole OVA: 0-4 ppm.	
					37									
	4	SS	11.0	13.0	7	21	40	24	SP				Slight Odor.	
					47									
	5	SS	13.0	15.0	3	9	19	24	SP				Slight Odor.	
15					29							15.0		
													Bottom of Boring at 15.0 Ft.	

Notes:

1. Temporary 4-inch-diameter steel wash casing was driven to a depth of 7 feet.

2. Boring was advanced using mud rotary wash with 3-7/8-inch-diameter tricone roller bit.

3. Upon completion, borehole was backfilled with cement/bentonite grout mixture.

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BORING LOG

PROJECT No. 90-407
BORING No. S-104
LOGGED BY PRS
PAGE No. 1 of 1

PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4,502.9 E 5,070.3 SURFACE ELEVATION 584.5
DRILLER Fox Drilling Inc. DATE: START 11/20/90 FINISH 11/20/90

DEPTH	SAMPLE No.	TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5														
	1	SS	5.0	7.0	2	4	9	24	SP			6.0	Brown to Gray Fine to Medium Sand, Wet.	
					13							7.0	Dark Gray Fine to Medium Sand, Wet. Odor and Oily Sheen.	
	2	SS	7.0	9.0	2	12	23	18	SP				Gray Fine to Medium Sand, Wet. Odor.	
					28									
10	3	SS	9.0	11.0	8	12	18	24	SP				Slight Odor.	
					17									
	4	SS	11.0	13.0	6	16	27	24	SP				Slight Odor. OVA: 1 ppm.	
					23									
	5	SS	13.0	15.0	7	13	30	24	SP				Slight Odor.	
15					23							15.0		
													Bottom of Boring at 15.0 Ft.	

Notes:

1. Temporary 4-inch-diameter steel wash casing was driven to a depth of 7 feet.

2. Boring was advanced using mud rotary wash with 3-7/8-inch-diameter tricone roller bit.

3. Upon completion, borehole was backfilled with cement/bentonite grout mixture.

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BORING LOG

PROJECT No. 90-407
BORING No. S-105
LOGGED BY PRS
PAGE No. 1 of 1

PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4,525.9 E 4,955.5 SURFACE ELEVATION 584.5
DRILLER Fox Drilling Inc. DATE: START 11/26/90 FINISH 11/26/90

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0"-6"	BLOW COUNT 6"-12"	BLOW COUNT 12"-18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	7.0	10	13	18	24	SP				Brown Fine to Medium Sand, Wet.	
					17									
	2	SS	7.0	9.0	3	9	18	24	SP				Gray Fine to Medium Sand, Wet.	
					22									
10	3	SS	9.0	11.0	3	8	16	15	SP				Dark Gray Fine to Medium Sand, Wet. Slight Odor.	
					20									
	4	SS	11.0	13.0	9	20	22	18	SP				Faint Odor.	
					27									
	5	SS	13.0	15.0	10	13	18	18	SP				Faint Odor.	
15					20									
20														
												24.0		
25	6	SS	24.0	26.0	12	20	35	18	SW			25.5	Dark Gray Fine to Coarse Sand, Wet.	
					37				CL			26.0	Brown Silty Clay, Trace Fine to Coarse Sand, Dry.	
													Bottom of Boring at 26.0 Ft.	
													Notes:	
													1. Temporary 4-inch-diameter steel wash casing was driven to a depth of 7 feet.	
													2. Boring was advanced using mud rotary wash with 3-7/8-inch-diameter tricone roller bit.	
													3. Upon completion, borehole was backfilled with cement/bentonite grout mixture.	

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BORING LOG

PROJECT No. 90-407
BORING No. S-106
LOGGED BY PRS
PAGE No. 1 of 1

PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4,524.6 E 5,007.1 SURFACE ELEVATION 584.5
DRILLER Fox Drilling Inc. DATE: START 11/21/90 FINISH 11/21/90

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0"-6"	BLOW COUNT 6"-12"	BLOW COUNT 12"-18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	7.0	3	4	8	24	SP				Brown Fine to Medium Sand, Wet.	
					22							7.0		
	2	SS	7.0	9.0	3	8	13	18	SP				Gray Fine to Medium Sand, Wet.	
					23									
10	3	SS	9.0	11.0	9	14	41	18	SP				Slight Odor.	
					37									
	4	SS	11.0	13.0	13	22	30	15	SP				Slight Odor.	
					32									
	5	SS	13.0	15.0	13	32	37	18	SP					
15					41									
20														
												24.0	Gray Fine to Coarse Sand, Wet. Fine to Coarse	
25	6	SS	24.0	24.8	20	50/3"		9	SW			24.8	Gravel in Tip of Spoon.	
													Bottom of Boring at 24.8 Ft.	

Notes:

1. Temporary 4-inch-diameter steel wash casing was driven to a depth of 7 feet.

2. Boring was advanced using mud rotary wash with 3-7/8-inch-diameter tricone roller bit.

3. Upon completion, borehole was backfilled with cement/bentonite grout mixture.

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BORING LOG

PROJECT No. 90-407
BORING No. S-107
LOGGED BY PRS
PAGE No. 1 of 1

PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4,490.9 E 4,952.7 SURFACE ELEVATION 584.5
DRILLER Fox Drilling Inc. DATE: START 11/26/90 FINISH 11/26/90

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	7.0	7	9	13	24	SP				Dark Gray Fine to Medium Sand, Wet. Slight Odor.	
					15									
	2	SS	7.0	9.0	2	4	9	18	SP				Slight Odor.	
10					13									
	3	SS	9.0	11.0	8	17	18	18	SP				Slight Odor.	
					20									
	4	SS	11.0	13.0	9	17	16	21	SP				Slight Odor.	
					22									
	5	SS	13.0	15.0	9	16	18	15	SP				No Odor.	
15					20									
20														
												24.0		
25	6	SS	24.0	26.0	21	38	29	21	SW			25.5	Dark Gray Fine to Coarse Sand, Wet.	
					4				CL			26.0	Brown Silty Clay, Trace Fine to Coarse Sand, Dry.	
													Bottom of Boring at 26.0 Ft.	

Notes:

1. Temporary 4-inch-diameter steel wash casing was driven to a depth of 7 feet.

2. Boring was advanced using mud rotary wash with 3-7/8-inch-diameter tricone roller bit.

3. Upon completion, borehole was backfilled with cement/bentonite grout mixture.

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BORING LOG

PROJECT No. 90-407
BORING No. S-108
LOGGED BY PRS
PAGE No. 1 of 1

PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4,495.3 E 5,018.3 SURFACE ELEVATION 584.5
DRILLER Fox Drilling Inc. DATE: START 11/21/90 FINISH 11/21/90

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	7.0	5	8	19	24	SP			6.0	Brown Fine to Medium Sand, Wet.	
					31								Gray Fine to Medium Sand, Wet.	
	2	SS	7.0	9.0	1	3	3	15	SP				Slight Odor.	
					7									
10	3	SS	9.0	11.0	10	26	38	18	SP				Slight Odor.	
					36									
	4	SS	11.0	13.0	14	28	31	18	SP				Faint Odor.	
					35									
	5	SS	13.0	15.0	19	34	37	18	SP				No Odor.	
15					38									
20														
25	6	SS	24.0	26.0	32	34	47	18	SP				Gray Fine to Medium Sand, Wet.	
					50							26.0		
													Bottom of Boring at 26.0 Ft.	

Notes:

1. Temporary 4-inch-diameter steel wash casing was driven to a depth of 7 feet.

2. Boring was advanced using mud rotary wash with 3-7/8-inch-diameter tricone roller bit.

3. Upon completion, borehole was backfilled with cement/bentonite grout mixture.

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BORING LOG

PROJECT No. 90-407
BORING No. S-109
LOGGED BY PRS
PAGE No. 1 of 1

PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4,262.4 E 5,155.3 SURFACE ELEVATION 585.0
DRILLER Fox Drilling Inc. DATE: START 11/19/90 FINISH 11/19/90

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	7.0	3 8	6	11	18	SP				Brown Fine to Medium Sand, Moist to Wet.	
10														
15	2	SS	15.0	17.0	15 37	26	27	18	SP				Dark Gray Fine to Medium Sand, Wet. Slight Odor.	
20														
25	3	SS	24.0	26.0	21 33	37	31	18	SM			24.0	Dark Gray Silty Fine Sand, Wet. Odor. OVA: 1-2 ppm.	
												26.0	Bottom of Boring at 26.0 Ft.	

Notes:

1. Temporary 4-inch-diameter steel wash casing was driven to a depth of 7 feet.

2. Boring was advanced using mud rotary wash with 3-7/8-inch-diameter tricone roller bit.

3. Upon completion, borehole was backfilled with cement/bentonite grout mixture.

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BORING LOG

PROJECT No. 90-407
BORING No. S-110
LOGGED BY PRS
PAGE No. 1 of 1

PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4,291.1 E 5,023.9 SURFACE ELEVATION 585.5
DRILLER Fox Drilling Inc. DATE: START 11/19/90 FINISH 11/19/90

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" 6" 6" 12" 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	7.0	3 8 12 / 13	18	SP				Brown to Gray Fine to Medium Sand, Wet.	
10												
15	2	SS	15.0	17.0	16 27 33 / 42	18	SP				Dark Gray Fine to Medium Sand, Wet.	
20												
25	3	SS	24.0	25.8	10 16 30 / 50/4"	15	SM			24.0	Dark Gray Silty Fine to Medium Sand, Trace of Clay, Wet. Odor.	
							SW			25.5		
										25.8	Dark Gray Fine to Coarse Sand, Wet. Odor.	
											Bottom of Boring at 25.8 Ft.	

Notes:

1. Temporary 4-inch-diameter steel wash casing was driven to a depth of 7 feet.

2. Boring was advanced using mud rotary wash with 3-7/8-inch-diameter tricone roller bit.

3. Upon completion, borehole was backfilled with cement/bentonite grout mixture.

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BORING LOG

PROJECT No. 90-407
BORING No. S-111
LOGGED BY PRS
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PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4,113.5 E 5,062.3 SURFACE ELEVATION 586.8
DRILLER Fox Drilling Inc. DATE: START 11/20/90 FINISH 11/20/90

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	7.0	10	10	15	15	SP				Brown Fine to Medium Sand, Wet.	
					16									
10														
15	2	SS	15.0	17.0	5	19	29	18	SP				Brownish Gray Fine to Medium Sand, Wet.	
					29									
20														
												24.0		
25	3	SS	24.0	26.0	15	21	25	18	SM				Gray Silty Fine to Medium Sand, Wet.	
					26							26.0		
													Bottom of Boring at 26.0 Ft.	

Notes:

1. Temporary 4-inch-diameter steel wash casing was driven to a depth of 7 feet.

2. Boring was advanced using mud rotary wash with 3-7/8-inch-diameter tricone roller bit.

3. Upon completion, borehole was backfilled with cement/bentonite grout mixture.

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BORING LOG

PROJECT No. 90-407
BORING No. S-112
LOGGED BY PRS
PAGE No. 1 of 1

PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4,069.7 E 5,072.3 SURFACE ELEVATION 586.9
DRILLER Fox Drilling Inc. DATE: START 11/20/90 FINISH 11/20/90

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	7.0	10	16	15	18	SP				Brown Fine to Medium Sand, Wet.	
					14									
10														
15	2	SS	15.0	17.0	14	26	22	18	SP				Gray Fine to Medium Sand, Wet.	
					26									
20														
												24.0		
25	3	SS	24.0	26.0	22	30	39	18	SP				Gray Fine Sand, Wet.	
					42							26.0		
													Bottom of Boring at 26.0 Ft.	

Notes:

1. Temporary 4-inch-diameter steel wash casing was driven to a depth of 7 feet.

2. Boring was advanced using mud rotary wash with 3-7/8-inch-diameter tricone roller bit.

3. Upon completion, borehole was backfilled with cement/bentonite grout mixture.

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BORING LOG

PROJECT No. 90-407
BORING No. S-113
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PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4,324.6 E 5,155.3 SURFACE ELEVATION 585.5
DRILLER Fox Drilling Inc. DATE: START 11/16/90 FINISH 11/16/90

DEPTH	SAMPLE No.	SAMPLE TYPE	SAMPLE INTERVAL FROM	SAMPLE INTERVAL TO	BLOW COUNT 0"-6"	BLOW COUNT 6"-12"	BLOW COUNT 12"-18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	7.0	8	8	9	24	SP			6.0	Brownish Gray Fine to Medium Sand, Wet.	
					16				SP				Dark Gray Fine to Medium Sand, Wet.	
10														
15	2	SS	15.0	17.0	13	18	20	18	SP				Dark Gray Fine to Medium Sand, Wet. Slight Odor.	
					25									
20														
25	3	SS	24.0	26.0	10	12	15	18	SM			25.5	Dark Gray Silty Fine Sand, Wet.	
					21				SW			26.0	Dark Gray Silty Fine to Coarse Sand, Wet.	
													Bottom of Boring at 26.0 Ft.	

Notes:

1. Temporary 4-inch-diameter steel wash casing was driven to a depth of 7 feet.

2. Boring was advanced using mud rotary wash with 3-7/8-inch-diameter tricone roller bit.

3. Upon completion, borehole was backfilled with cement/bentonite grout mixture.

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BORING LOG

PROJECT No. 90-407
BORING No. S-114
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PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4562.92 E 5358.29 SURFACE ELEVATION 584.5
DRILLER Fox Drilling Inc. DATE: START 1/3/91 FINISH 1/3/91

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	7.0	8	10	13	18	SP				Gray Fine to Medium Sand, Wet.	
					16									
10														
15	2	SS	15.0	17.0	9	13	21	21	SP				Dark Gray Fine to Medium Sand, Wet.	
					24									
20														
25	3	SS	25.0	27.0	9	9	10	21	SP				Dark Gray Fine to Medium Sand, Wet.	
					15									
30													Bottom of Boring at 27.0 Ft.	

Notes:

1. Boring was advanced using 4-1/4-in. hollow-stem augers.

2. Upon completion, borehole was backfilled with a cement/bentonite grout mixture.

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BORING LOG

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PROJECT No. 90-407
BORING No. S-115
LOGGED BY PRS
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PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4701.74 E 5372.77 SURFACE ELEVATION 584.5
DRILLER Fox Drilling Inc. DATE: START 1/3/91 FINISH 1/3/91

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	7.0	10	9	12	18	SP				Brown to Gray Fine to Medium Sand, Wet.	
					17									
10														
15	2	SS	15.0	17.0	4	6	8	18	SP				Dark Gray Fine to Medium Sand, Wet.	
					8									
20														
25	3	SS	25.0	27.0	8	9	21	24	SP				Dark Gray Fine to Medium Sand, Wet. Odor.	
					25									
30													Bottom of Boring at 27.0 Ft.	

Notes:

1. Boring was advanced using 4-1/4-in. hollow-stem augers.

2. Upon completion, borehole was backfilled with a cement/bentonite grout mixture.

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BORING LOG

PROJECT No. 90-407
BORING No. S-116
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PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION East of LMS In-Out Building SURFACE ELEVATION 584.5
DRILLER Fox Drilling Inc. DATE: START 1/4/91 FINISH 1/4/91

DEPTH	SAMPLE No.	SAMPLE TYPE	SAMPLE INTERVAL FROM	SAMPLE INTERVAL TO	BLOW COUNT 0" to 6"	BLOW COUNT 6" to 12"	BLOW COUNT 12" to 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	7.0	16	10	13	18	SP				Brown Fine to Medium Sand, Wet.	
					15									
10														
15	2	SS	15.0	16.5	18	35	39	18	SP				Dark Gray Fine to Medium Sand, Wet.	
20														
25	3	SS	25.0	26.5	13	16	21	15	SP				Dark Gray Fine to Medium Sand, Wet. Slight Odor.	
													Bottom of Boring at 26.5 Ft.	
30													**Notes:**	
													1. Boring was advanced using 4-1/4-in. hollow-stem augers.	
													2. Upon completion, borehole was backfilled with a cement/bentonite grout mixture.	

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BORING LOG

PROJECT No. 90-407
BORING No. S-117
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PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION East of LMS In-Out Building SURFACE ELEVATION 584.5
DRILLER Fox Drilling Inc. DATE: START 1/4/91 FINISH 1/4/91

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in).	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	7.0	8	11	16	15	SP				Brown Fine to Medium Sand, Wet.	
					17									
10														
15	2	SS	15.0	17.0	7	9	9	15	SP				Dark Gray Fine to Medium Sand, Wet. Odor.	
					14									
20														
25	3	SS	25.0	26.5	10	12	15	12	SP				Dark Gray Fine to Medium Sand, Wet. Odor.	
													Bottom of Boring at 26.5 Ft.	
30													Notes: 1. Boring was advanced using 4-1/4-in. hollow-stem augers. 2. Upon completion, borehole was backfilled with a cement/bentonite grout mixture.	

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BORING LOG

PROJECT No. 90-407
BORING No. S-118
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PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4476.17 E 5049.88 SURFACE ELEVATION 584.8
DRILLER Fox Drilling Inc. DATE: START 1/23/91 FINISH 1/23/91

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" to 6"	BLOW COUNT 6" to 12"	BLOW COUNT 12" to 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5														
	1	SS	6.0	8.0	8	15	18	21	SP					
					20								Gray Fine to Medium Sand, Wet.	
	2	SS	8.0	10.0	2	6	11	24	SP					
10					14								Odor and Oily Appearance in All Samples.	
	3	SS	10.0	12.0	6	12	19	18	SP					
					13							12.0		
													Bottom of Boring at 12.0 Ft.	
15													Notes:	
													1. Boring was advanced using 4-1/4-in. hollow-stem augers.	
													2. Upon completion, borehole caved in and remaining open space was backfilled with cuttings.	

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BORING LOG

PROJECT No. 90-407
BORING No. S-119
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PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois

BORING LOCATION N 4480.73 E 5078.59 SURFACE ELEVATION 584.78

DRILLER Fox Drilling Inc. DATE: START 1/23/91 FINISH 1/23/91

DEPTH	SAMPLE No.	SAMPLE TYPE	SAMPLE INTERVAL FROM	SAMPLE INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5														
	1	SS	6.0	8.0	6	14	24	24	SP					
					37								Dark Gray Fine to Medium Sand, Wet.	
	2	SS	8.0	10.0	9	12	18	18	SP					
10					20								Odor and Oily Appearance in Samples 2 and 3.	
	3	SS	10.0	12.0	5	9	14	21	SP					
					16							12.0		
													Bottom of Boring at 12.0 Ft.	
15													Notes:	
													1. Boring was advanced using 4-1/4-in. hollow-stem augers.	
													2. Upon completion, borehole caved in and remaining open space was backfilled with cuttings.	

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BORING LOG

PROJECT No. 90-407
BORING No. S-120
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PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4509.35 E 5046.22 SURFACE ELEVATION 584.73
DRILLER Fox Drilling Inc. DATE: START 1/23/91 FINISH 1/23/91

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	4.0	6.0	7	8	10	18	SP				Gray Fine to Medium Sand, Wet.	
					13							6.0		
													Bottom of Boring at 6.0 Ft.	
10													Notes:	
													1. Boring was advanced using 4-1/4-in. hollow-stem augers.	
													2. Upon completion, borehole caved in and remaining open space was backfilled with cuttings.	

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BORING LOG

PROJECT No. 90-407
BORING No. S-121
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PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4511.43 E 5077.16 SURFACE ELEVATION 584.86
DRILLER Fox Drilling Inc. DATE: START 1/23/91 FINISH 1/23/91

DEPTH	SAMPLE No.	SAMPLE TYPE	SAMPLE INTERVAL FROM	SAMPLE INTERVAL TO	BLOW COUNT 0" to 6"	BLOW COUNT 6" to 12"	BLOW COUNT 12" to 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	4.0	6.0	7	8	7	18	SP			6.0	Gray Fine to Medium Sand, Wet.	
					7									
													Bottom of Boring at 6.0 Ft.	
10													Notes:	
													1. Boring was advanced using 4-1/4-in. hollow-stem augers.	
													2. Upon completion, borehole caved in and remaining open space was backfilled with cuttings.	

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BORING LOG

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PROJECT No. 90-407
BORING No. S-122
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PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4528.33 E 5050.27 SURFACE ELEVATION 585.11
DRILLER Fox Drilling Inc. DATE: START 1/23/91 FINISH 1/23/91

DEPTH	SAMPLE No.	SAMPLE TYPE	SAMPLE INTERVAL FROM	SAMPLE INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	4.0	6.0	3	6	8	18	SP				Brown Fine to Medium Sand, Wet.	
					9							6.0		
													Bottom of Boring at 6.0 Ft.	
10													Notes:	
													1. Boring was advanced using 4-1/4-in. hollow-stem augers.	
													2. Upon completion, borehole caved in and remaining open space was backfilled with cuttings.	

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BORING LOG

PROJECT No. 90-407
BORING No. S-123
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PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4526.84 E 5079.12 SURFACE ELEVATION 585.48
DRILLER Fox Drilling Inc. DATE: START 1/23/91 FINISH 1/23/91

DEPTH	SAMPLE No.	SAMPLE TYPE	SAMPLE INTERVAL FROM	SAMPLE INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	4.0	6.0	7	7	8	18	SP				Brown Fine to Medium Sand, Wet.	
					9							6.0		
													Bottom of Boring at 6.0 Ft.	
10													Notes:	
													1. Boring was advanced using 4-1/4-in. hollow-stem augers.	
													2. Upon completion, borehole caved in and remaining open space was backfilled with cuttings.	

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BORING LOG

PROJECT No. 90-407
BORING No. S-124
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PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois

BORING LOCATION N 4531.63 E 5104.13 SURFACE ELEVATION 585.34

DRILLER Fox Drilling Inc. DATE: START 1/23/91 FINISH 1/23/91

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" to 6"	BLOW COUNT 6" to 12"	BLOW COUNT 12" to 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	4.0	6.0	7	12	13	18	SP				Brown Fine to Medium Sand, Wet.	
					13							6.0		
													Bottom of Boring at 6.0 Ft.	
10													Notes:	
													1. Boring was advanced using 4-1/4-in. hollow-stem augers.	
													2. Upon completion, borehole caved in and remaining open space was backfilled with cuttings.	

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BORING LOG

PROJECT No. 90-407
BORING No. S-125
LOGGED BY PRS
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PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4534.77 E 5121.04 SURFACE ELEVATION 585.3
DRILLER Fox Drilling Inc. DATE: START 1/23/91 FINISH 1/23/91

DEPTH	SAMPLE No.	SAMPLE TYPE	SAMPLE INTERVAL FROM	SAMPLE INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	4.0	6.0	6	9	11	18	SP				Brown Fine to Medium Sand, Wet.	
					15							6.0		
													Bottom of Boring at 6.0 Ft.	
10													Notes:	
													1. Boring was advanced using 4-1/4-in. hollow-stem augers.	
													2. Upon completion, borehole caved in and remaining open space was backfilled with cuttings.	

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BORING LOG

PROJECT No. 90-407
BORING No. S-126
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PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4626.19 E 5384.30 SURFACE ELEVATION 585.33
DRILLER Fox Drilling Inc. DATE: START 1/24/91 FINISH 1/24/91

DEPTH	SAMPLE No.	SAMPLE TYPE	SAMPLE INTERVAL FROM	SAMPLE INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	6.5	6	13	15	15	SP				Brown to Gray Fine to Medium Sand, Wet.	
10														
15	2	SS	15.0	16.5	12	21	23	18	SP				Dark Gray Fine to Medium Sand, Wet.	
20														
25	3	SS	25.0	26.5				15	SP				Dark Gray Fine to Medium Sand, Wet.	
30													Bottom of Boring at 26.5 Ft. Notes: 1. Boring was advanced using 4-1/4-in. hollow-stem augers. 2. Upon completion, borehole was backfilled with a cement/bentonite grout mixture.	

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BORING LOG

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PROJECT No. 90-407
BORING No. S-127
LOGGED BY PRS
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PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4652.16 E 5328.54 SURFACE ELEVATION 584.85
DRILLER Fox Drilling Inc. DATE: START 1/24/91 FINISH 1/24/91

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in).	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	6.5	6	9	13	15	SP				Brown Fine to Medium Sand, Wet.	
15	2	SS	15.0	16.5	11	9	13	18	SP				Dark Gray Fine to Medium Sand, Wet.	
25	3	SS	25.0	26.5	22	34	33	15	SP				Dark Gray Fine to Medium Sand, Wet.	
30													Bottom of Boring at 26.5 Ft. Notes: 1. Boring was advanced using 4-1/4-in. hollow-stem augers. 2. Upon completion, borehole was backfilled with a cement/bentonite grout mixture.	

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BORING LOG

PROJECT No 90-407
BORING No. S-132
LOGGED BY PRS/WJC
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PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4491.18 E 5079.59 SURFACE ELEVATION 584
DRILLER Exploration Technology Inc. DATE: START 2/26/91 FINISH 2/26/91

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5														
10														
15														
20	1	SS	18.0	20.0	11	11	17	21	SP					
					29									
	2	SS	21.0	23.0	19	15	17	24	SP				Gray Fine to Medium Sand, Wet.	
					28									
25	3	SS	24.0	26.0	15	19	23	21	SP					
					22									
30													Bottom of Boring at 26.0 Ft.	

Notes:

1. Boring was advanced using 6-1/4-in. hollow-stem augers.

2. Upon completion, borehole caved in and remaining open space was backfilled with cuttings.

Canonie

BORING LOG

PROJECT No. 90-407
BORING No. S-133
LOGGED BY PRS
PAGE No. 1 of 1

PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4478.56 E 5081.62 SURFACE ELEVATION 584
DRILLER Exploration Technology Inc. DATE: START 2/27/91 FINISH 2/27/91

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" to 6"	BLOW COUNT 6" to 12"	BLOW COUNT 12" to 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5														
10														
15														
20	1	SS	18.0	20.0	12	15	22	18	SP					
					34									
	2	SS	21.0	23.0	18	30	35	18	SP				Dark Gray Fine to Medium Sand, Wet.	
					24									
25	3	SS	24.0	26.0	19	32	50	18	SP					
					46									
30													Bottom of Boring at 26.0 Ft.	

Notes:

1. Boring was advanced using 6-1/4-in. hollow-stem augers.

2. Upon completion, borehole caved in and remaining open space was backfilled with cuttings.

Canonie

BORING LOG

PROJECT No. 90-407
BORING No. S-134
LOGGED BY WJC
PAGE No. 1 of 1

PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4491.26 E 5105.25 SURFACE ELEVATION 584.5
DRILLER Exploration Technology Inc. DATE: START 2/27/91 FINISH 2/27/91

DEPTH	SAMPLE No.	SAMPLE TYPE	SAMPLE INTERVAL FROM	SAMPLE INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
20	1	SS	18.0	20.0	7	7	20	24	SP				Gray Fine to Medium Sand, Wet.	
					29									
	2	SS	21.0	22.3	22	30	50/4	16	SP					
25	3	SS	23.0	25.0	20	30	31	18	SP					
					20									
													Bottom of Boring at 25.0 Ft.	
													Notes:	
30													1. Boring was advanced using 6-1/4-in. hollow-stem augers.	
													2. Upon completion, borehole caved in and remaining open space was backfilled with cuttings.	

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BORING LOG

PROJECT No. 90-407
BORING No. S-135
LOGGED BY WJC
PAGE No. 1 of 1

PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4480.09 E 5100.56 SURFACE ELEVATION 584.5
DRILLER Exploration Technology Inc. DATE: START 2/27/91 FINISH 2/27/91

DEPTH	SAMPLE No.	SAMPLE TYPE	SAMPLE INTERVAL FROM	SAMPLE INTERVAL TO	BLOW COUNT 0" 6"	BLOW COUNT 6" 12"	BLOW COUNT 12" 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5														
10														
15														
20	1	SS	18.0	20.0	8 50	10	25	21	SP					
	2	SS	21.0	22.3	38	28	50/4	16	SP				Gray Fine to Medium Sand, Wet.	
25	3	SS	24.0	26.0	10 32	10	28	24	SP					
													Bottom of Boring at 26.0 Ft.	
30													Notes: 1. Boring was advanced using 6-1/4-in. hollow-stem augers. 2. Upon completion, borehole caved in and remaining open space was backfilled with cuttings.	

Rev. 8-88

Canonie

BORING LOG A-32

PROJECT No. 90-407
BORING No. S-136
LOGGED BY WJC
PAGE No. 1 of 1

PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4519.69 E 5115.48 SURFACE ELEVATION 583.5
DRILLER Exploration Technology Inc. DATE: START 2/27/91 FINISH 2/27/91

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0" to 6"	BLOW COUNT 6" to 12"	BLOW COUNT 12" to 18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	7.0	15	9	6	12	SP				Black Fine to Medium Sand, Wet. Oily Sheen.	
					6							7.0		
	2	SS	7.0	9.0	10	17	27	16	SP				Gray Fine to Medium Sand, Wet.	
					31									
10	3	SS	9.0	10.5	5	11	22	20	SP					
					50/3							10.8	Bottom of Boring at 10.8 Ft.	
15													Notes: 1. Boring was advanced using 6-1/4-in. hollow-stem augers. 2. Upon completion, borehole caved in and remaining open space was backfilled with cuttings.	

Rev. 8-88

Canonie

BORING LOG

PROJECT No. 90-407
BORING No. S-137
LOGGED BY WJC
PAGE No. 1 of 1

PROJECT NAME Waukegan Harbor Remediation Project, Waukegan, Illinois
BORING LOCATION N 4517.98 E 5094.55 SURFACE ELEVATION 583.5
DRILLER Exploration Technology Inc. DATE: START 2/27/91 FINISH 2/27/91

DEPTH	SAMPLE No.	SAMPLE TYPE	INTERVAL FROM	INTERVAL TO	BLOW COUNT 0"-6"	BLOW COUNT 6"-12"	BLOW COUNT 12"-18"	REC (in)	USCS SOIL TYPE	WC (%)	qu (TSF)	LAYER DEPTH	SOIL DESCRIPTION AND REMARKS	PIEZO
5	1	SS	5.0	7.0	12	14	20	19	SP				Black Fine to Medium Sand, Wet. Oily Sheen.	
					24							7.0		
	2	SS	7.0	9.0	4	8	13	20	SP				Gray Fine to Medium Sand, Wet.	
					17									
10	3	SS	9.0	10.5	5	17	50	14	SP			10.5	Bottom of Boring at 10.5 Ft.	
15													Notes: 1. Boring was advanced using 6-1/4-in. hollow-stem augers. 2. Upon completion, borehole caved in and remaining open space was backfilled with cuttings.	

Rev. 8-88

APPENDIX B

CORRESPONDENCE

CanonieEnvironmental

Canonie Environmental Services
800 Canonie Drive
Porter, Indiana 46304
Phone: 219-926-6651
Fax: 219-926-7569

December 21, 1990

90-407-04

Ms. Cindy J. Nolan
Remedial Project Manager
U.S. Environmental Protection Agency
Region V
Emergency and Remedial Response Branch
230 South Dearborn
Chicago, IL 60604

Request for Approval
Redefinition of Limits of Designated Soils
Waukegan Harbor Remediation Project
Waukegan, Illinois

Dear Ms. Nolan:

Based on preliminary results obtained from the sampling program, Canonie Environmental Services Corp. (Canonie) is requesting that U.S. Environmental Protection Agency (EPA) approve the following redefinition of the limits of 'designated soils' in the New Slip area at the Waukegan Harbor Site. First, soils within the boundaries of Area C would not be defined as designated soils. Second, the vertical limit of excavation within Area A would be 10 feet below ground surface. Finally, the eastern limit of Area A would be expanded to encompass soils encountered while trenching.

This redefinition would allow for Area C soils to be left in place. The resultant decrease in volume of designated soils would increase the factor of safety involved with available volume in the designated soils stockpile.

The bases for this request are preliminary analytical results for the samples taken from Soil Borings S-103 and S-104, drilled withing Area A, and S-105 through S-108, drilled within Area C, and samples taken from the trenches excavated for the south sheet pile wall. The boring samples were taken from the following depths:

Soil Boring	Sample Depth (feet)
S-103	9.0 - 11.0
S-104	11.0 - 13.0
S-105	9.0 - 11.0
S-106	11.0 - 13.0
S-107	9.0 - 11.0
S-108	9.0 - 11.0

The trenching samples were taken from depths between two-and-one-half and five feet. All sampling locations are shown on the enclosed Figure 1. The results are summarized in Table 1.

The samples from borings S-105 through S-108 contained total concentrations of carcinogenic polynuclear aromatics (PNAs) well below the criteria level of six parts per million (ppm). In fact, all of the carcinogenic PNAs were found to be below the detection limit of 0.40 ppm in each boring. Trenching Samples S-1, S-2, S-4, and S-5, taken from within the limits of Area C, also contained no carcinogenic PNAs. Trenching Sample S-6 contained 5.28 ppm of carcinogenic PNAs and 11.07 ppm of total PNAs, which is less than the criteria level. The results indicate that no PNA impacts are present in Area C at depths of five feet and 10 feet. Therefore, it is not necessary for these soils to be contained in the stockpile.

Results from samples taken from Soil Borings S-103 and S-104 indicate that the vertical extent of carcinogenic PNAs above six ppm discovered in earlier sampling programs is between a depth of five and 12 feet. Based on the results, Canonie proposes to excavate soils north of the original south wall line and within Area A to a depth of 10 feet. Excavation south of the original south wall line and within Area A would be completed to a depth of 12 feet.

Results for Trenching Sample S-3 indicate that the discolored soils encountered east of Area A must be defined as designated soils due to the high carcinogenic and total PNA concentrations. However, Trenching Sample S-4, which was taken approximately three to four feet west of Trenching Sample S-3, from visually clean soil, contained only 0.12 ppm total PNAs. The delineation between the discolored and clean soils is very evident. The impacted area extends about 40 feet to the east and is about three to four feet deep. Canonie proposes to extend Area A to the east and excavate and contain the discolored soils in the designated soils stockpile.

Also included are results for air monitoring samples taken while the south wall trench was open. Sample KA12119004 represents a sampling location within the exclusion zone next to the open trench in Area C. All results were below the detection limit, further supporting the redefinition of Area C soils as nondesignated soils.

Please review the data included and inform us of your decision concerning the redefined designated soils limits. Barring any interruptions in work, the south sheet pile wall will be completed by January 22, 1990 and the south tie-back wall will be driven during the first week of January 1991. Excavation of designated soils will commence shortly thereafter. The timing of your decision will affect the construction of the tie-back wall because the present design calls for sheeting driven to the hard silty clay layer to isolate the Area C soils. If Area C is redefined to be comprised of nondesignated soils, a savings of approximately 1700 square feet of sheeting can be realized. The tie-back wall in Area C can therefore be constructed using sheeting lengths of nine feet instead of 26 feet.

Finally, a figure depicting the current dimensions for the New Slip is enclosed for your review. This alignment reflects the discussions of Outboard Marine Corporation with Larsen Marine Service. Formal approval of this alignment is requested. Revised construction drawings are being finalized and will be submitted during the week of January 1, 1991.

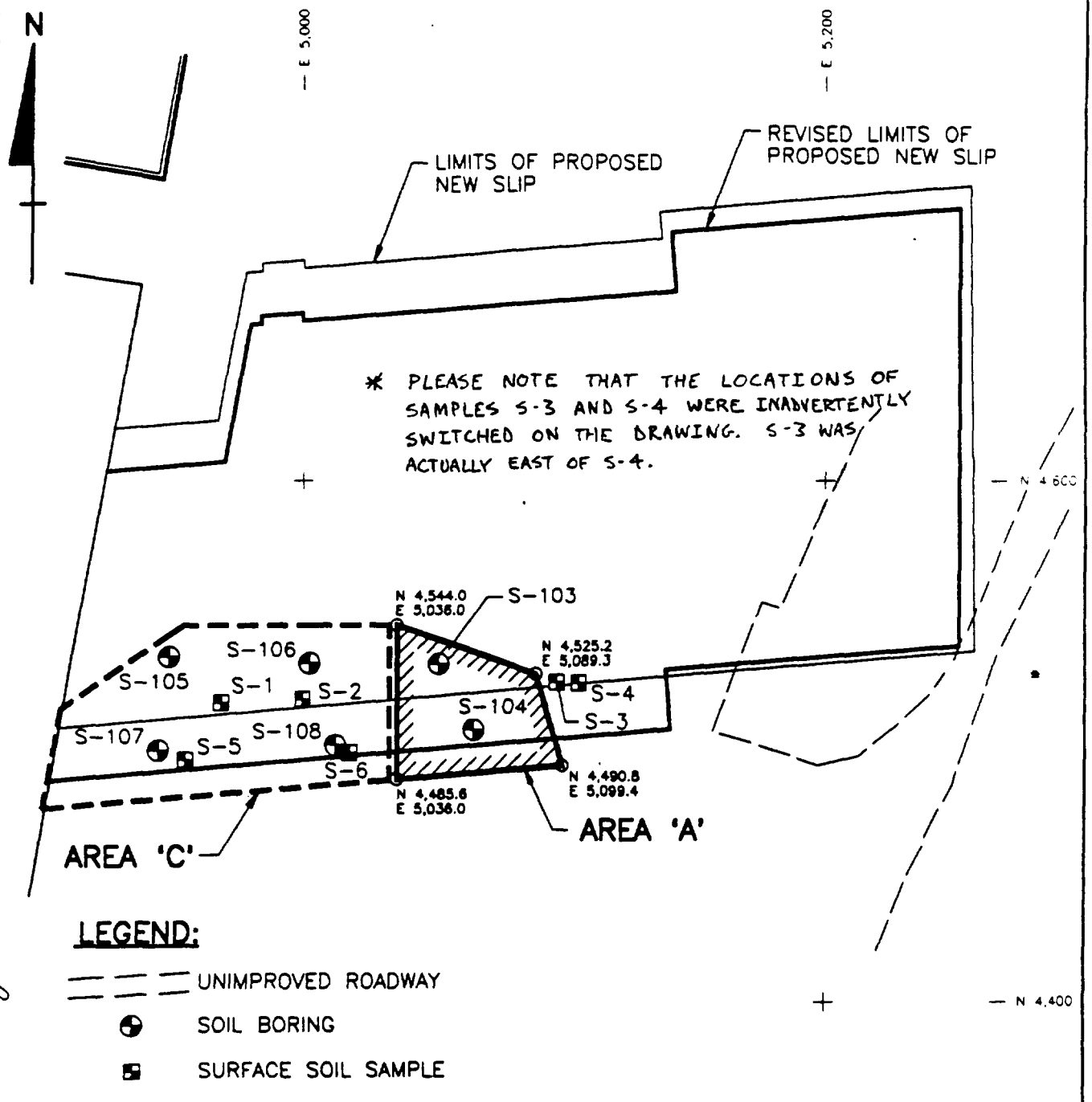
Your timely review of and response to this issue would be greatly appreciated. If you have any questions, please call me at (219) 926-8651.

Very truly yours,

Steven L. Gerken, P.E.
Technical Manager

SLG/tl

Attachments



LEGEND:

- UNIMPROVED ROADWAY
- SOIL BORING
- SURFACE SOIL SAMPLE

PRELIMINARY RESULTS (ppm)		
BORING No.	TOTAL CARC. PNAs	TOTAL PNAs
S-103	0.00	8.20
S-104	1.09	18.53
S-105	0.00	2.50
S-106	0.00	17.61
S-107	0.00	6.20
S-108	0.00	6.15
S-1	0.00	2.48
S-2	0.00	0.04
S-3	168.00	322.30
S-4	0.00	0.12
S-5	0.00	0.00
S-6	5.28	11.07

SCALE

60 0 60 FEET

SOIL SAMPLE LOCATIONS
WAUKEGAN HARBOR, WAUKEGAN, ILLINOIS

PREPARED FOR

WAUKEGAN HARBOR TRUST

CanonieEnvironmental

DATE: 12-14-90	FIGURE 1	DRAWING NUMBER 87-126-A233
SCALE: AS SHOWN		

REVISIONS

NO	DATE	
1	12-14-90	ISSUED TO CLIENT DRE/SLG
2	12-20-90	ISSUED TO AGENCY DRE/

DRAWN BY: DRE 12-14-90
CHECKED BY: APPROVED BY: 12/20/90 12/21/90

DRAWING NUMBER 87-126-A233

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

REPLY TO ATTENTION OF:

January 24, 1991

Mr. Glen Lenzi
Outboard Marine Corp.
100 Sea Horse Dr.
Waukegan, IL 60068

Re: Response to Redefinition of Designated Soils
Request of December 21, 1990

Dear Glen,

As per our conference call of January 18, 1991, I am providing the following response to the request for approval for redefining the limits of the designated soil.

I agree that Area C generally appears to be free of the contaminated soil which is characterized by the PAH compounds, However, sample S-6 appears to be associated with Area A instead of Area C.

The data seem to indicate that Area A is better defined by a semi-circle (between the tie-back sheet piling, S-6, S-103, S-4, back to the tie-back sheet piling) instead of the straight lines portrayed. If Figure 1 had shown the previous sample results, this would have been clearer. Please present the data this way in the future, and please show the tie-back sheet piling as well. Results from sample boring S-81 are missing from the data table summaries I have, and it may be within the tie-back wall area which needs to be removed.

As discussed in our call, additional samples are planned for the area around S-52 and beneath the cement footings found near S-3

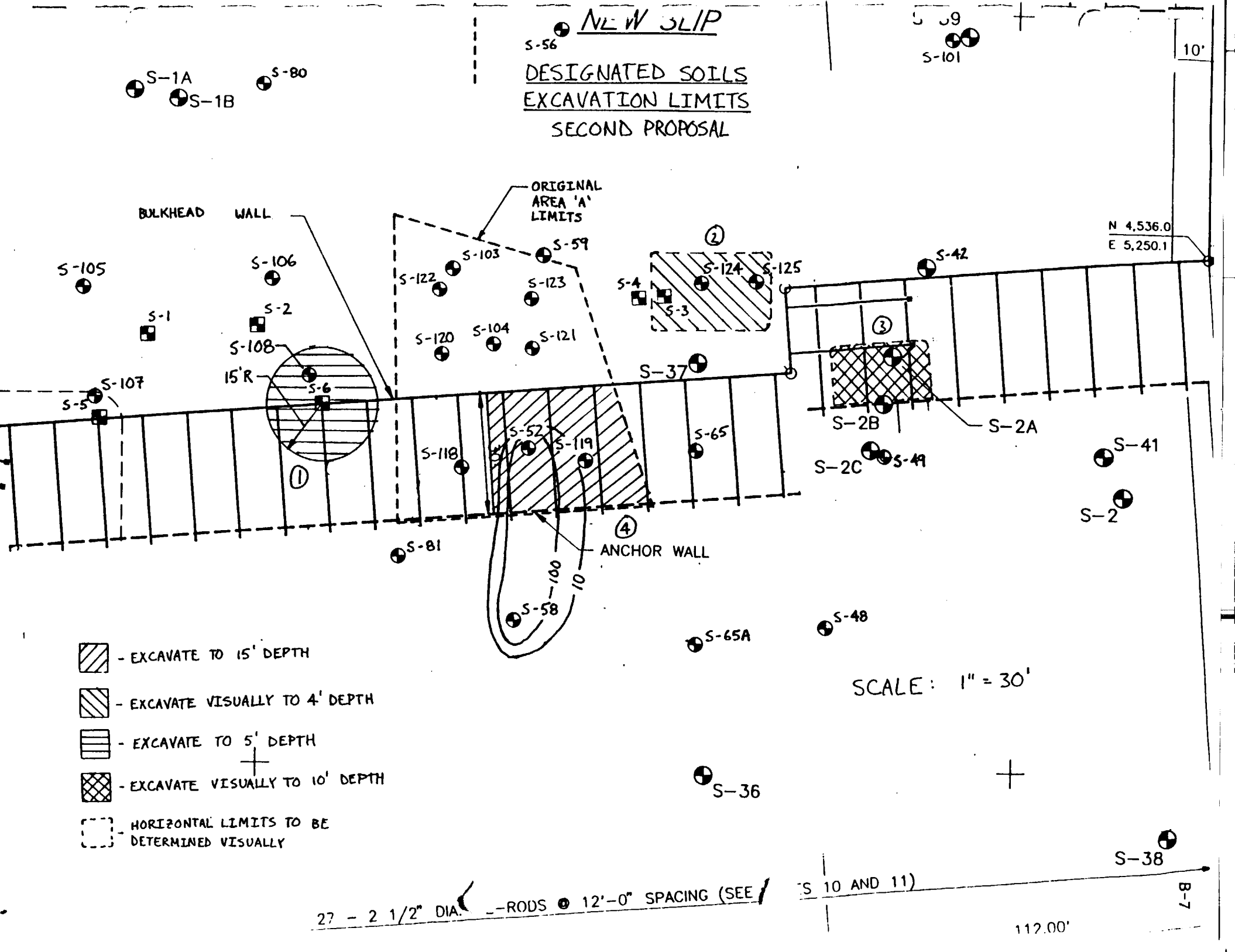
and S-4 to determine depth of contamination. As agreed, concurrence on the Area A definition is not expected in this letter.

Call if you have any questions.

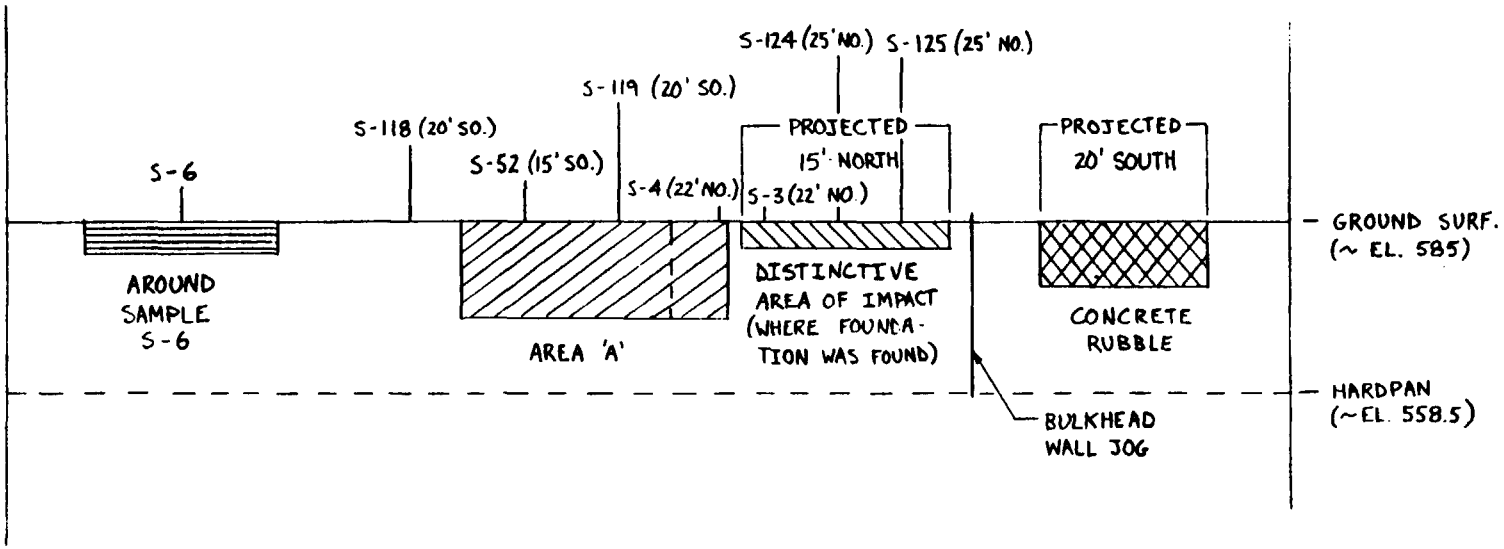
Sincerely,

Cindy J. Nolan
Remedial Project Manager

cc: Scott Moyer, IEPA
Shamel Abou-El-Soud, USACE
Ed Abat, USACE
Steve Gerken


NEW SLIP
DESIGNATED SOILS
EXCAVATION LIMITS
SECOND PROPOSAL
S-56
S-101
S-1A
S-1B
S-80
10'
BULKHEAD WALL
ORIGINAL AREA 'A' LIMITS
N 4,536.0
E 5,250.1
S-105
S-106
S-103
S-59
S-122
S-123
S-124
S-125
S-42
S-4
S-3
S-1
S-2
S-120
S-104
S-121
S-108
15'R
S-6
S-37
S-107
S-5
S-118
S-52
S-119
S-65
S-2B
S-2A
S-2C
S-49
S-41
S-2
ANCHOR WALL
S-81
100
10
S-58
S-48
S-65A
S-36
S-38
- EXCAVATE TO 15' DEPTH
- EXCAVATE VISUALLY TO 4' DEPTH
- EXCAVATE TO 5' DEPTH
- EXCAVATE VISUALLY TO 10' DEPTH
HORIZONTAL LIMITS TO BE DETERMINED VISUALLY
SCALE: 1" = 30'
27 - 2 1/2" DIA. -RODS @ 12'-0" SPACING (SEE
S 10 AND 11)
B-7
112.00'

DESIGNATED SOILS EXCAVATION
PROFILE ALONG SOUTH BULKHEAD
WALL LOOKING NORTH



VSCALE - 1" = 30'
HSCALE - 1" = 30'

Canonie

By ____ Date ____ Subject ____ Sheet No. ____ of ____

Chkd. By ____ Date ____ Proj. No. ____

1/4" X 1/4"

B-8

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

REPLY TO ATTENTION OF:

February 15, 1991

Mr. Glen Lenzi
Outboard Marine Corp.
100 Sea Horse Dr.
Waukegan, IL 60086-2195

Dear Glen,

Pursuant to our conference call of February 13, I am trying to provide an expedient response to OMC/Canonie's excavation limit proposal for contaminated soils as desired to continue field work. This discussion was based on the data and diagram faxed on February 12.

1) The area encompassing S-3 to S-125 is removed based on visual delineation of the contamination (estimated at approximately 4 feet deep). This is acceptable. A confirmatory sample needs to be taken below the removed material to assure that remaining materials are clean.

2) The area encompassing S-2A and S-2B is also based on visual delineation of the contamination. This too, is acceptable. A confirmatory sample is needed below the removed material to assure that remaining materials are clean.

3) Removal of the recommended soil volume around sample S-6 is acceptable. In checking the approved design (Appendix M, p. M-6), I note that S-105, S-106, S-107 and S-108 were to have samples taken at the till interface. These data are either not reported or the samples were not taken. Please have Canonie resolve this discrepancy and provide the data required by the approved design.

4) Area A, south of the Bulkhead wall has significant contamination below 12 feet, as represented by S-119. The proposal to remove down to 15 feet is based on convenience, not compliance with the design. This is not acceptable. EPA can only approve proposals which resolve the problem, not which rationalize avoiding it. The depth of contamination needs to be determined as per design requirements and the soil removed accordingly.

In addition, for the data transmitted on December 21, 1990, I need further clarification of sample definition. For example, I assume "FR" means field replicate, but of what sample? I also do not know actual sample depth, particularly for samples outside the New Slip area. In short, the lab data sheets and boring logs alone do not provide sufficient information to determine whether the design and QAPP have been complied with. Please keep this in mind when transmitting the data.

Sincerely,

Cindy J. Nolan
Remedial Project Manager

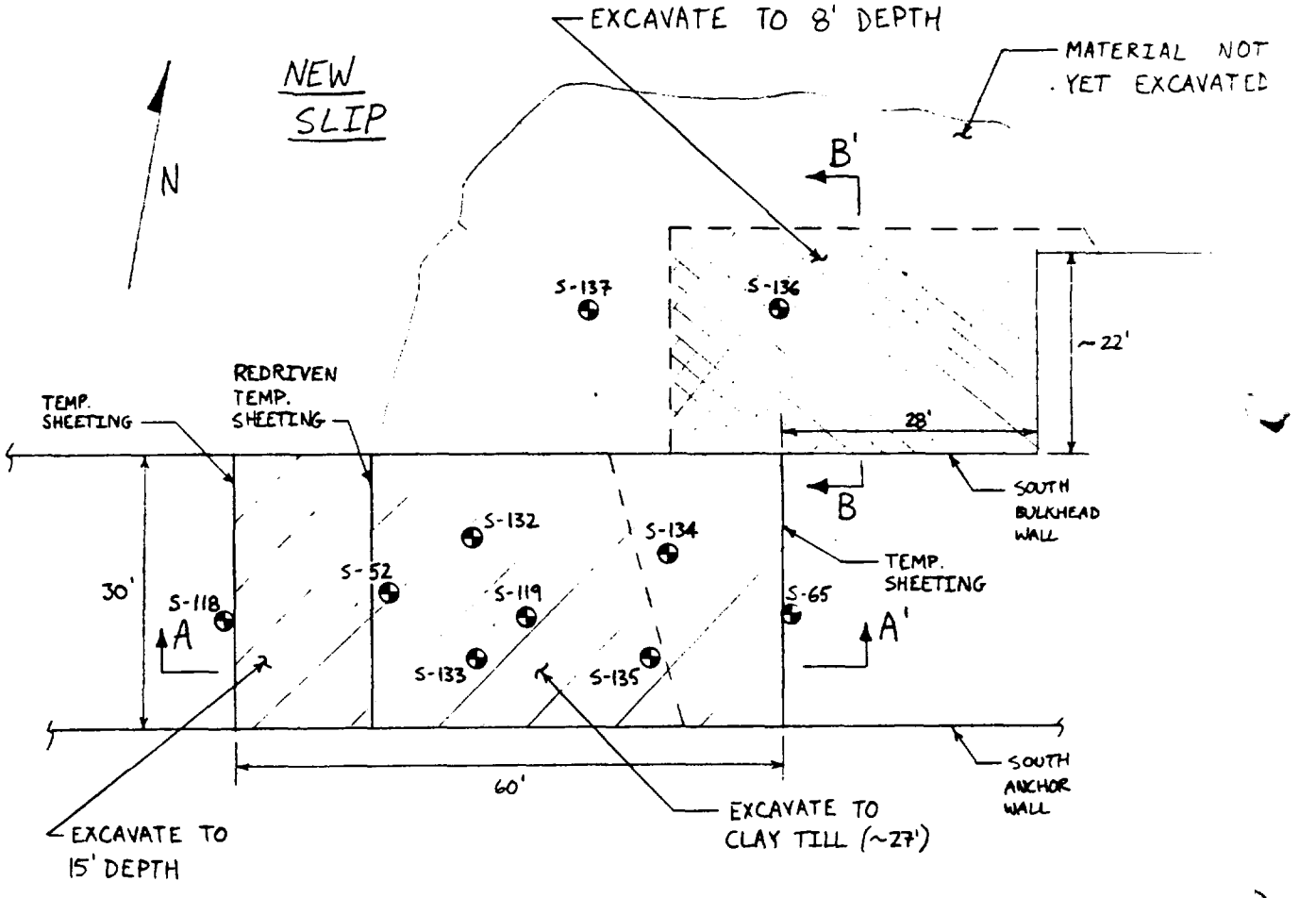
cc: Steve Gerken, Canonie
Ed Abat, USACE
Shamel Abou-El-Soud, USACE
Scott Moyer, IEPA
Sean Mulroney, ORC

Canonie

By PRS Date 3-18-91 Subject PNA Soils Excavation Areas Sheet No. 1 of 2

Chkd. By ____ Date ____ Fourth Proposal Proj. No. 90-407-04

1/4" X 1/4"



SCALE: 1" = 20'

---- ORIGINAL AREA A BOUNDARIES

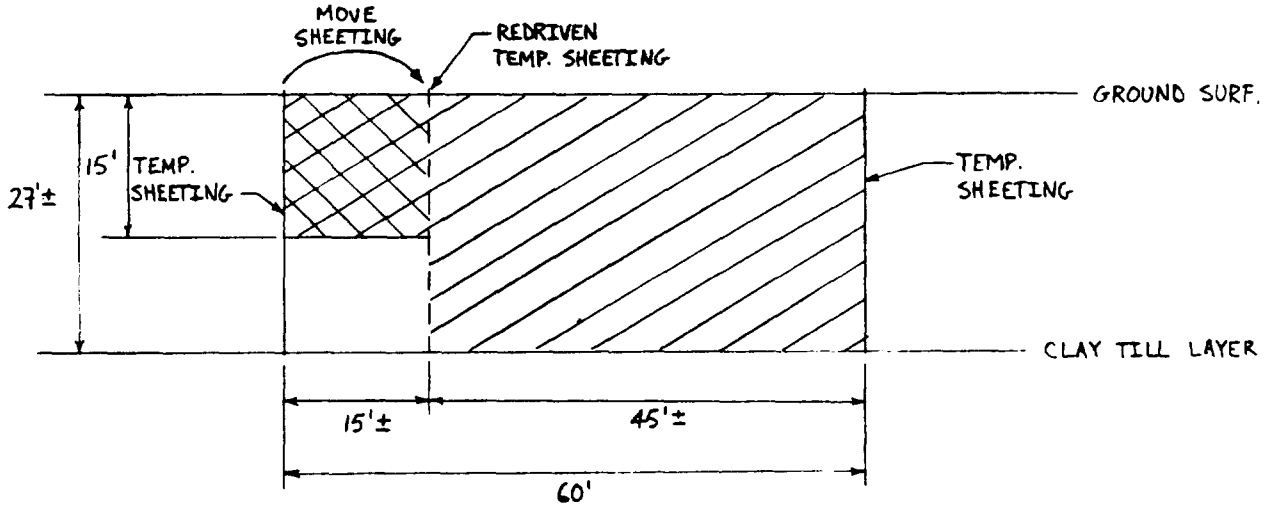
Canonie

B-12

By PRS Date 3-18-91 Subject PNA Soils Excavation Sheet No. 2 of 2

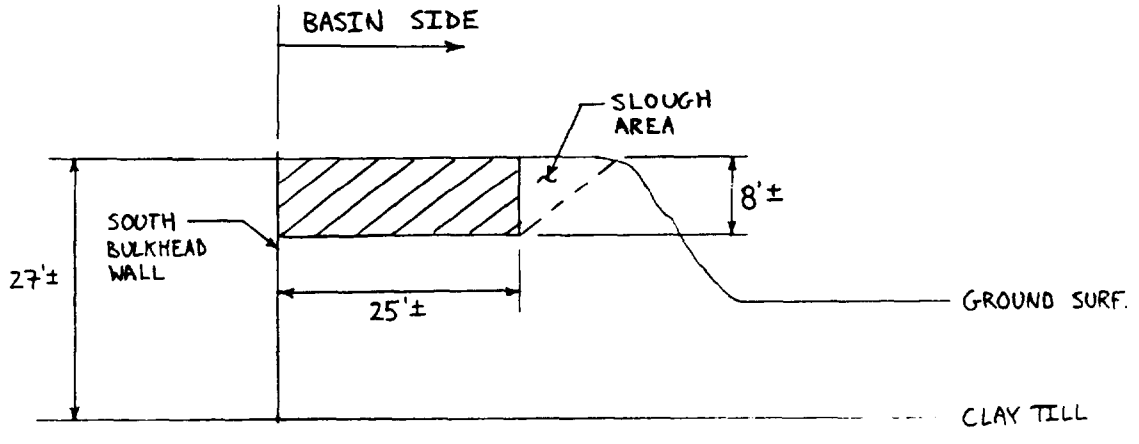
Chkd. By ____ Date ____ Cross Sections A-A' & B-B' Proj. No. 90-407-04

Fourth Proposal 1/4" X 1/4"



CROSS SECTION A-A'
SCALE: 1" = 20'
LOOKING NORTH

- EXCAVATE TO 15'
- EXCAVATE TO CLAY



CROSS SECTION B-B'
SCALE: 1" = 20'
LOOKING WEST

- EXCAVATE TO 8'

OMC

OUTBOARD MARINE CORPORATION

100 Sea-Horse Drive
Waukegan, Illinois 60085
Phone 708 689-6200
Telex 025-3891

June 20, 1991

Ms. Cindy Nolan (5HS 230-11)
U.S. Environmental Protection Agency
230 S. Dearborn Street
Chicago, Illinois 60604

Dear Cindy:

In accordance with our recent discussions and your May 29, 1991 verbal request, I submitted copies of three reports (Anspec, McCrone, and Geraghty & Miller) which we commissioned. This letter sets forth the purpose of those reports, and provides a summary of the information presented therein.

I am also transmitting a copy of several laboratory analysis reports which apparently were never transmitted to you. Three of the sediment samples were obtained from the upper harbor outside of the New Slip cutoff wall. The remaining sediment sample was obtained from the middle of the New Slip across from the select soils excavation area (Area A). A review of the New Slip water/sediment data previously submitted by Canonie and the new data is provided.

Anspec and McCrone Reports

The Anspec and McCrone laboratory work was undertaken in an effort to identify the floating materials, characterized by IEPA as "oily scum", which were observed in the New Slip during its construction. The Geraghty & Miller report is an update of their earlier ground water modeling report which was submitted in support of the New Slip construction plan.

This work was initiated after OMC became aware of the New Slip water quality concerns that surfaced in late March and early April. During this time the Trust's contractor was excavating the PNA contaminated "select" soils from the area immediately adjacent to the New Slip (Area A), including the Agency ordered deep excavation of select soils from portions of Area A. Simultaneously, New Slip excavation and vibratory placement of the New Slip sheeting were in progress. During this construction activity some floating scum (with an oily appearance) was observed on the surface of the exposed ground water in the excavated portions of the New Slip. Although the Trust's contractor informed us of their belief that such scum formation directly resulted from the Area A "select soils" excavation work and/or the driving of the slip sheeting with

a diesel driven vibratory hammer, we also speculated that surfactant associated with the upper harbor water may have contributed to the scum formation. As I informed you at that time OMC has experienced on at least a couple of occasions excessive foaming of upper harbor water in its HI-2 harbor water intake system. On those occasions, we believed that detergents resulting from spring/fall boat cleaning at Larsen Marine caused the foaming action. Since the New Slip water level was below Harbor level, the Harbor water would recharge the New Slip excavation and could have introduced surfactants into the New Slip.

In addition, although IEPA indicated the possibility of other sources of oily materials entering the New Slip at or near the northeast corner of the excavation , our tests and observations, as well as those of the contractor and the U.S. Army Corps of Engineers, never identified any other significant source of the oil or oily appearing materials. We believe that the floating materials noted by IEPA were wind driven to the northeast portion of the New Slip excavation.

Based on the Anspec and McCrone work, we concluded that the foam consisted of three phases, one solid and the other two liquid. The solids identified were primarily fractured sand fines. While the liquid phase contained two distinct components one reported as hydrocarbons (with characteristic of coal tar residues) and the other, characterized as white foam, was determined to be a long chain, potentially polymeric. This information is suggestive that the white foam may have acted as a surfactant for hydrophobic (oily) materials present in or around the New Slip area during the construction.

Geraghty & Miller Report

The Geraghty & Miller modeling report provides information for comparing the expected ground water flow to the New Slip and Harbor that result from modifications that were made to the New Slip design following the agencies' approval of the Work Plan in October, 1990. The modifications included a slight relocation (approximately 60 feet) of the New Slip to the north, the lengthening of the steel sheeting side walls by 100 feet, and the provision of a two foot wide slurry wall (10^{-7} cm/sec or lower permeability) at the beach end of the slip that is tied into the steel sheeting side walls.

The boundary conditions used in the model include the Harbor/Lake water elevations (579.9) for the eastern, western, and southern sides of the peninsula. The North Ditch, elevation 581, provides the northern boundary. A hydraulic conductivity of $1x10^{-2}$ cm/sec was used to compute the ground water transport. This conductivity was used by Canonie in the Waukegan Harbor Design Report, although the

value appears to be very conservative (meaning higher ground water flow rates) than was determined by the JRB Report prepared for USEPA. The maximum and minimum mean site hydraulic conductivity determined by on-site testing and presented in the JRB Report were $6x10^{-3}$ and $1x10^{-3}$ cm/sec, respectively. Use of either of these values in the model would yield significantly lower amounts of expected ground water transport. In addition the simulations assumed a permeability of $1x10^{-7}$ cm/sec for the slurry wall, and permeabilities of $1x10^{-4}$ cm/sec (manufacturer's general information) and $2x10^{-5}$ cm/sec (Canonie field information from Area A excavation) for the steel sheeting.

The ground water modeling indicates that the extended slip with slurry wall results in an incremental decrease of 21 to 94 percent in the ground water discharge to the upper harbor over the New Slip design presented in and approved in New Slip work plan. Likewise, the estimated flow to the New Slip area is also reduced by 6.1 to 56.2 percent (13.5 gpm to 5.9 - 12.6 gpm depending on the sheet piling effective permeability).

Additional Sediment & Water Data

As noted above, three upper harbor sediment samples were collected to obtain additional background information prior to opening the New Slip to the Harbor. The samples were analyzed for volatiles, semi-volatiles, and metals. Two of the samples contained reportable levels of PNA's (17.7 and 28.3 mg/kg), while the third sample indicated the presence of PNA's but below the quantification limit. Phenols (5.9 mg/kg) were reported in one sample but not the other two. Metals results are comparable to previously reported soil/sediment data.

An additional New Slip sediment sample was collected on 5/2/91, approximately two weeks after excavation activities in the area had ceased and suspended or floating solids in the New Slip water had substantially dissipated. Both phenols (6.8 mg/kg) and PNA's (24 mg/kg) were found in this sample; however, they are below the select soils action levels previously determined by the agencies.

Water samples were collected from both the upper harbor and new slip on 4/25/91 and were analyzed for cyanides in accordance with your request. The Harbor and New Slip sample results were reported as below detection and 0.02 mg/l, respectively. The laboratory detection limit for cyanide is 0.02 mg/l (Standard Methods 17th Edition and USEPA Method EPA-600/4-82-057). Both these values are at or below the detection limit. Additionally, sediment/soils samples were collected from the New Slip area and analyzed for cyanide. The results, included in the attached data submittal, were all reported to be less than the detection limit of 0.5 mg/kg.

The additional laboratory data reports, enclosed as Attachment A, do not provide any new information that would modify the water quality or sediment data conclusions previously submitted by Canonie to the agencies.

New Slip Sediment and Water Data Summary

A total of four sediment samples were obtained from the New Slip after completion of the excavation activities. Three of the samples were required by the approved Work Plan and the fourth was collected at OMC's request to address potential contamination concerns that arose during the excavation of certain portions of Area A. In addition one of the required beach end sediment samples was specifically taken in a location which IEPA had expressed concerns about a potential oil seep (also referenced above in the Anspec/McCrone discussion). All of the beach end sediment results, including the IEPA designated sample location, indicated that PNA's and phenols were present but at concentrations below laboratory quantification levels (reference Table 2 of the Canonie May 16, 1991 transmittal). The fourth sample (also discussed above) contained PNA's at 24 mg/kg and phenols at 6.8 mg/kg, well below the prescribed action levels.

Three sets of water samples were collected in the New Slip and one set of background water samples were taken in the upper portion of Waukegan Harbor. The first New Slip water sample was collected at the agencies request on April 8, 1991 during excavation of the deep portions of Area A PNA soils. Additional New Slip water samples were collected on April 19 and April 30, 1991. Contaminants of concern included: volatiles (benzene, toluene, ethylbenzene, and toluene), PNA's, phenols and arsenic.

The April 8 sample reports indicated that the water met Illinois water quality criteria for all reported parameters except phenols and arsenic. The arsenic levels were marginally over the water quality criteria and most likely were associated with materials suspended in the water as a result of the excavation activities in both the New Slip and Area A. Arsenic is a naturally occurring element in soils that is commonly found in the 1 to 50 PPM range. The initial New Slip phenol concentrations (15.3 and 20.3 mg/l) largely reflects the rapid flux of ground water into the depressed water table (3 to 7 feet below the surrounding ground water and harbor water elevations) into the New Slip.

Water samples were also collected from the New Slip on April 9 and April 30. The phenol concentrations declined rapidly to 1.5 mg/l and 0.046 mg/l, respectively. The April 19 sample also revealed a decline in the arsenic concentration to a level (0.02 mg/l) which is substantially equivalent to the Illinois General Use Water Quality Standard.

The phenol concentration decline is most likely the result of rapid biodegradation (data indicates a half-life on the order of 2 to 3 days, as was suggested in the Geraghty & Miller (1990) report), while the arsenic concentration decline is most likely attributable to the settlement of suspended materials. In any event the most recent water analysis data indicates that the New Slip water now meets all potentially applicable Illinois water quality criteria. Additionally, the Geraghty & Miller Risk Assessment for New Slip Construction (January, 1990) submitted in support of the New Slip Work Plan considered the background phenol concentrations in the ground water and concluded that the incremental impact of ground water flow from the New Slip area to the Harbor would be insignificant. Based on the revisions made to the New Slip construction plans, Geraghty & Miller now concludes that the expected incremental impact of ground water flow through the New Slip area is now 6 to 56 % less than flow presented in the plan originally considered and approved by the agencies. Therefore, the potential impact of opening the New Slip into the Harbor has been reduced further and no significant effect on Harbor water quality is expected.

Conclusion

We believe that the Waukegan Harbor Trust has completed all elements of the New Slip Work Plan, including the required water and sediment analysis. Further, the water and sediment analysis collected after completion of the sheet piling and excavation activities indicate that the New Slip meets the guidelines and potentially applicable Illinois water quality criteria established under the Work Plan. The Trust has also advised us that all the inventoried water from the select soil containment cell has been treated and released to the New Slip in accordance with the approved treatment and discharge plan. Therefore, we urge the agencies to approve the Trust's (Canonie's) request to remove the sand plug and sheeting which separates the New Slip from the Harbor.

Sincerely,

J. R. Crawford, P.E.
Corporate Director
Environmental Control

Enc.
JRC/vm
cc: Al Albrecht w/o enc.
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Tim Harrington "
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